ELEMENTARY
CORE Academy

UTAH STATE OFFICE OF EDUCATION & UTAH STATE UNIVERSITY

2008 Participant Handbook

UTAH STATE OFFICE OF EDUCATION

UtahState UNIVERSITY

ELEMENTARY CORE ACADEMY

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ISBN: 1-890563-57-9

Acknowledgements

These materials have been produced by and for the teachers of the State of Utah. Appreciation is expressed to the numerous individuals who provided input and effort into the creation of this curriculum. Delivery of the Elementary CORE Academy, including the development and delivery of content, coordination of sessions, distribution of materials, and participant interaction, has been a collaborative effort of many educational groups across Utah. The following organizations, Utah teachers, and educational leaders contributed ideas and activities as part of this professional development project:

Organizations:

Utah State Office of Education (USOE)
Utah State University (USU)
State Science Education Coordination Committee (SSECC)
State Mathematics Education Coordination Committee (SMECC)
Special Education Services Unit (USOE)

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UTAH STATE OFFICE OF EDUCATION

Leadership…Service…Accountability

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Dear CORE Academy Teachers:

Thank you for your investment in children and in building your own expertise as you participate in the Elementary CORE Academy. I hope your involvement helps you to sustain a laser-like focus on student achievement.

Teachers in Utah are superb. By participating in the Academy, you join a host of teachers throughout the state who understand that teaching targeted on the core curricula, across a spectrum of subjects, will produce results of excellence. The research is quite clear–the closer the match of explicit instruction to core standards, the better the outcome on core assessments.

I personally appreciate your excellence and your desire to create wonderful classrooms of learning for students. Thank you for your dedication. I feel honored to associate with you and pledge my support to lead education in ways that benefit all of our children.

Sincerely,

Patti Harrington, Ed.D.
State Superintendent of Public Instruction

Funding Sources

Appreciation is expressed for the tremendous educational input and monetary commitment of several organizations for the successful delivery of the Elementary CORE Academy. This year's Elementary CORE Academy was developed and funded through a variety of sources. The Utah State Office of Education (USOE), in collaboration with Utah State University (USU) and local school districts of Utah, have supported kindergarten through sixth grade teachers with professional development experiences that will enhance the educational experience for Utah children.

Major funding for the Academy comes from the following sources:

Federal/State Funds:

Utah State Office of Education
- Staff Development Funds
- Special Education Services Unit

ESEA Title II

Utah Math Science Partnership

District Funds:

Various sources including Quality Teacher Block, Federal ESEA Title II, and District Professional Development Funds

School Funds:

Trust land, ESEA Title II, and other school funds
Utah State Office of Education Special Education Services

The state and district funds are allocations from the state legislature. ESEA is part of the "No Child Left Behind" funding that comes to Utah.

Additionally, numerous school districts, individual schools, and principals in Utah have sponsored teachers to attend the Academy. Other educational groups have assisted in the development and delivery of resources in the Academy.

Most important is the thousands of teachers who take time from their summer to attend these professional development workshops. It is these teachers who make this program possible.

Goals of the Elementary CORE Academy

Overall

The purpose of the Elementary CORE Academy is to create high quality teacher instruction and improve student achievement through the delivery of professional development opportunities and experiences for teachers across Utah.

The Academy will provide elementary teachers in Utah with:

1. Models of exemplary and innovative instructional strategies, tools, and resources to meet Core Curriculum standards, objectives, and indicators.
2. Practical models and diverse methods of meeting the learning needs of all children, with instruction implementation aligned to the Core Curriculum.
3. Meaningful opportunities for collaboration, self-reflection, and peer discussion specific to innovative and effective instructional techniques, materials, teaching strategies, and professional practices in order to improve classroom instruction.

Learning a limited set of facts will no longer prepare a student for real experiences encountered in today's world. It is imperative that educators have continued opportunities to obtain instructional skills and strategies that provide methods of meeting the needs of all students. Participants of the Academy experience will be better equipped to meet the challenges faced in today's classrooms.

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Introduction

Most children enter school confident in their own abilities; they are curious and eager to learn more. They make sense of the world by reasoning and problem solving. Young students are building beliefs about what mathematics is, about what it means to know and do mathematics, and about themselves as mathematical learners. Students use mathematical tools, such as manipulative materials and technology, to develop conceptual understanding and solve problems as they do mathematics. Students, as mathematicians, learn best through participatory experiences throughout the instruction of the mathematics curriculum.

- Mathematics instruction needs to include more than short-term learning of rote procedures.

Recognizing that no term captures completely all aspects of expertise, competence, knowledge, and facility in mathematics, the term *mathematical proficiency* has been chosen to capture what it means to learn mathematics successfully. Mathematical proficiency has five strands: computing (carrying out mathematical procedures flexibly, accurately, efficiently, and appropriately), understanding (comprehending mathematical concepts, operations, and relations), applying (ability to formulate, represent, and solve mathematical problems), reasoning (logically explaining and justifying a solution to a problem), and engaging (seeing mathematics as sensible, useful, and doable, and being able to do the work) (NRC, 2001).

The most important observation about the five strands of mathematical proficiency is that they are interwoven and interdependent. This observation has implications for how students acquire mathematical proficiency, how teachers develop that proficiency in their students, and how teachers are educated to achieve that goal. At any given moment during a mathematics lesson or unit, one or two strands might be emphasized. But all the strands must eventually be addressed so that the links among them are strengthened. The integrated and balanced development of all five strands of mathematical proficiency should guide the teaching and learning of school mathematics. Instruction should not be based on the extreme positions that students learn solely by internalizing what a teacher or book says, or solely by inventing mathematics on their own.

The Elementary Mathematics Core describes what students should know and be able to do at the end of each of the K-6 grade levels. It was developed and revised by a community of Utah mathematics teachers, mathematicians, university mathematics educators, and

State Office of Education specialists. It was critiqued by an advisory committee representing a wide variety of people from the community, as well as an external review committee. The Core reflects the current philosophy of mathematics education that is expressed in national documents developed by the National Council of Teachers of Mathematics, the American Association for the Advancement of Science, and the National Research Council. This Mathematics Core has the endorsement of the Utah Council of Teachers of Mathematics. The Core reflects high standards of achievement in mathematics for all students.

Organization of the Elementary Mathematics Core

The Core is designed to help teachers organize and deliver instruction.

- Each grade level begins with a brief description of areas of instructional emphasis which can serve as organizing structures for curriculum design and instruction.
- The INTENDED LEARNING OUTCOMES (ILOs) describe the skills and attitudes students should acquire as a result of successful mathematics instruction. They are found at the beginning of each grade level and are an integral part of the Core.
- A STANDARD is a broad statement of what students are expected to understand. Several Objectives are listed under each Standard.
- An OBJECTIVE is a more focused description of what students need to know and be able to do at the completion of instruction. If students have mastered the Objectives associated with a given Standard, they have mastered that Standard at that grade level. Several Indicators are described for each Objective.
- INDICATORS are observable or measurable student actions that enable students to master an Objective. Indicators can help guide classroom instruction.
- MATHEMATICAL LANGUAGE AND SYMBOLS STUDENTS SHOULD USE includes language and symbols students should use in oral and written language.
- EXPLORATORY CONCEPTS AND SKILLS are included to establish connections with learning in subsequent grade levels. They are not intended to be assessed at the grade level indicated.

Intended Learning Outcomes for Third through Sixth Grade Mathematics

The main intent of mathematics instruction is for students to value and use mathematics and reasoning skills to investigate and understand the world.

The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should acquire as a result of successful mathematics instruction. They are an essential part of the Mathematics Core Curriculum and provide teachers with a standard for student learning in mathematics.

- ILOs describe the skills and attitudes students should learn as a result of mathematics instruction.

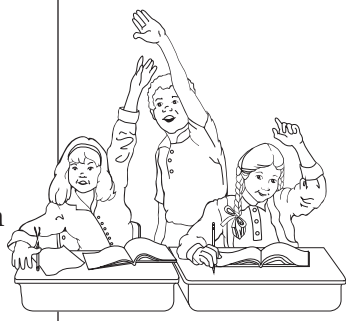
ILOs for mathematics:

1. **Develop a positive learning attitude toward mathematics.**
2. **Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.**
3. **Reason logically, using inductive and deductive strategies and justify conclusions.**
4. **Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.**
5. **Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.**
6. **Represent mathematical ideas in a variety of ways.**

Significant mathematics understanding occurs when teachers incorporate ILOs in planning mathematics instruction. The following are ideas to consider when planning instruction for students to acquire the ILOs:

1. **Develop a positive learning attitude toward mathematics.**

   When students are confident in their mathematical abilities, they demonstrate persistence in completing tasks. They pose mathematical questions about objects, events, and processes while displaying a sense of curiosity about numbers and patterns. It is important to build on students' innate problem-solving inclinations and to preserve and encourage a disposition that values mathematics.



2. **Become effective problem solvers by selecting appropriate methods, employing a variety of strategies, and exploring alternative approaches to solve problems.**

Problem solving is the cornerstone of mathematics. Mathematical knowledge is generated through problem solving as students explore mathematics. To become effective problem solvers, students need many opportunities to formulate questions and model problem situations in a variety of ways. They should generalize mathematical relationships and solve problems in both mathematical and everyday contexts.

3. **Reason logically, using inductive and deductive strategies and justify conclusions.**

   Mathematical reasoning develops in classrooms where students are encouraged to put forth their own ideas for examination. Students develop their reasoning skills by making and testing mathematical conjectures, drawing logical conclusions, and justifying their thinking in developmentally appropriate ways. Students use models, known facts, and relationships to explain reasoning. As they advance through the grades, students' arguments become more sophisticated.

4. **Communicate mathematical ideas and arguments coherently to peers, teachers, and others using the precise language and notation of mathematics.**

   The ability to express mathematical ideas coherently to peers, teachers, and others through oral and written language is an important skill in mathematics. Students develop this skill and deepen their understanding of mathematics when they use accurate mathematical language to talk and write about what they are doing. When students talk and write about mathematics, they clarify their ideas and learn how to make convincing arguments and represent mathematical ideas verbally, pictorially, and symbolically.

5. **Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.**

   Students develop a perspective of the mathematics field as an integrated whole by understanding connections within mathematics. Students should be encouraged to explore the connections that exist with other disciplines and between mathematics and their own experiences.

6. **Represent mathematical ideas in a variety of ways.**

   Mathematics involves using various types of representations including concrete, pictorial, and symbolic models. In particular, identifying and locating numbers on the number line has a central role in uniting all numbers to promote understanding of equivalent representations and ordering. Students also use a variety of mathematical representations to expand their capacity to think logically about mathematics.

Fourth Grade Mathematics Core Curriculum

By the end of grade four, students develop quick recall of the basic multiplication facts and related division facts. They develop fluency with efficient procedures for multiplying multidigit whole numbers, understand why the procedures work, and use them to solve problems. Students recognize decimal notation as an extension of the base-ten system. They relate their understanding of fractions to decimals. They generate equivalent fractions, simplify fractions, and identify equivalent fractions and decimals; compare and order whole numbers, simple fractions, and decimals to hundredths; and estimate decimal or fractional amounts in problem solving.

Students use transformations, including those that produce line and rotational symmetry. Students understand area as a measurable attribute of two-dimensional regions. They select appropriate units, strategies, and tools for solving problems that involve measuring area. They connect area measure to the area model for multiplication as a way to justify the formula for the area of a rectangle.

Standard I: **Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.**

Objective 1: Demonstrate multiple ways to represent whole numbers and decimals, from hundredths to one million, and fractions.

a. Read and write numbers in standard and expanded form.

b. Demonstrate multiple ways to represent whole numbers and decimals by using models and symbolic representations (e.g., 36 is the same as the square of six, three dozen, or 9 x 4).

c. Identify the place and the value of a given digit in a six-digit numeral, including decimals to hundredths, and round to the nearest tenth.

d. Divide regions, lengths, and sets of objects into equal parts using a variety of models and illustrations.

e. Name and write a fraction to represent a portion of a unit whole, length, or set for halves, thirds, fourths, fifths, sixths, eighths, and tenths.

f. Identify and represent square numbers using models and symbols.

Standard I:
Students will acquire number sense and perform operations with whole numbers, simple fractions, and decimals.

Objective 2: Analyze relationships among whole numbers, commonly used fractions, and decimals to hundredths.

a. Compare the relative size of numbers (e.g., 475 is comparable to 500; 475 is small compared to 10,000 but large compared to 98).

b. Order whole numbers up to six digits, simple fractions, and decimals using a variety of methods (e.g., number line, fraction pieces) and use the symbols <, >, and = to record the relationships.

c. Identify a number that is between two given numbers (e.g., 3.2 is between 3 and 4; find a number between 0.1 and 0.2).

d. Identify equivalences between fractions and decimals by connecting models to symbols.

e. Generate equivalent fractions and simplify fractions using models, pictures, and symbols.

Objective 3: Model and illustrate meanings of multiplication and division of whole numbers and the addition and subtraction of fractions.

a. Model multiplication (e.g., equal-sized groups, rectangular arrays, area models, equal intervals on the number line), place value, and properties of operations to represent multiplication of a one- or two-digit factor by a two-digit factor and connect the representation to an algorithm.

b. Use rectangular arrays to interpret factoring (e.g., find all rectangular arrays of 36 tiles and relate the dimensions of the arrays to factors of 36).

c. Demonstrate the mathematical relationship between multiplication and division (e.g., 3 x □= 12 is the same as 12 ÷ 3 = □and □= 4) and use that relationship to explain that division by zero is not possible.

d. Represent division of a three-digit dividend by a one-digit divisor, including whole number remainders, using a variety of methods (e.g., rectangular arrays, manipulatives, pictures), and connect the representation to an algorithm.

e. Use models to add and subtract simple fractions where one single-digit denominator is 1, 2, or 3 times the other (e.g., 2/4 + 1/4; 3/4 - 1/8).

Objective 4: Solve problems involving multiplication and division of whole numbers and addition and subtraction of simple fractions and decimals.

a. Use estimation, mental math, paper and pencil, and calculators to perform mathematical calculations and identify when to use each one appropriately.

b. Select appropriate methods to solve a single operation problem and estimate computational results or calculate them directly, depending on the context and numbers involved in a problem.

c. Write a story problem that relates to a given multiplication or division equation, and select and write a number sentence to solve a problem related to the environment.

d. Solve problems involving simple fractions and interpret the meaning of the solution (e.g., A pie has been divided into six pieces and one piece is already gone. How much of the whole pie is there when Mary comes in? If Mary takes two pieces, how much of the whole pie has she taken? How much of the pie is left?)

Objective 5: Compute problems involving multiplication and division of whole numbers and addition and subtraction of simple fractions and decimals.

a. Demonstrate quick recall of basic multiplication and division facts.

b. Multiply up to a three- digit factor by a two-digit factor with fluency, using efficient procedures.

c. Divide up to a three-digit dividend by a one-digit divisor with fluency, using efficient procedures.

d. Add and subtract decimals and simple fractions where one single-digit denominator is 1, 2, or 3 times the other (e.g., 2/4 + 1/4 = 3/4; 1/3 – 1/6 = 1/6).

Mathematical language and symbols students should use:
sum, difference, expanded form, standard form, square number, dividend, divisor, quotient, factor, product, array, multiple, numerator, denominator, sixths, eighths, tenths, equivalent, estimate, <, >, =, ≠

Exploratory Concepts and Skills

- Use concrete objects and visual models to add and subtract common decimals.
- Explore numbers less than zero by extending the number line and by using familiar applications such as temperature.
- Investigate the concept of ratio (e.g., the number of students to the number of teachers).

Standard II: Students will use patterns and relations to represent mathematical problems and number relationships.

Objective 1: Identify, analyze, and determine rules for describing numerical patterns involving operations and nonnumerical growing patterns.

a. Analyze growing patterns using objects, pictures, numbers, and tables to determine a rule for the pattern.

b. Recognize, represent, and extend simple patterns involving multiples and other number patterns (e.g., square numbers) using objects, pictures, numbers, and tables.

c. Identify simple relationships in real-life contexts and use mathematical operations to describe the pattern (e.g., the number of legs on a given number of chairs may be determined by counting by fours or by multiplying the number of chairs by 4).

Objective 2: Use algebraic expressions, symbols, and properties of the operations to represent, simplify, and solve mathematical equations and inequalities.

a. Use the order of operations to evaluate, simplify, and compare mathematical expressions involving the four operations, parentheses, and the symbols <, >, and = (e.g., 2x (4 - 1) + 3; of the two quantities 7 - (3 - 2) or (7 - 3) - 2, which is greater?).

b. Express single-operation problem situations as equations and solve the equation.

c. Recognize that a symbol represents the same number throughout an equation or expression (e.g., $\Delta + \Delta = 8$; thus, $\Delta = 4$).

d. Describe and use the commutative, associative, distributive, and identity properties of addition and multiplication, and the zero property of multiplication.

Mathematical language and symbols students should use:
growing pattern, order of operations, parentheses, inequality, expression, equation, associative property, commutative property, distributive property, zero property of multiplication, >, <, =

Exploratory Concepts and Skills
- Use concrete materials to build an understanding of equality and inequality.
- Explore properties of equality in number sentences (e.g., when equals are added to equals, then the sums are equal; when equals are multiplied by equals, then the products are equal).

Standard II: **Students will use patterns and relations to represent mathematical problems and number relationships.**

Standard III: Students will understand attributes and properties of plane geometric objects and spatial relationships.

Objective 1: Identify and describe attributes of two-dimensional geometric shapes.

a. Name and describe lines that are parallel, perpendicular, and intersecting.

b. Identify and describe right, acute, obtuse, and straight angles.

c. Identify and describe the radius and diameter of a circle.

d. Identify and describe figures that have line symmetry and rotational symmetry.

Objective 2: Specify locations using grids and maps.

a. Locate coordinates in the first quadrant of a coordinate grid.

b. Give the coordinates in the first quadrant of a coordinate grid.

c. Locate regions on a map of Utah.

d. Give the regions of a position on a map of Utah.

Objective 3: Visualize and identify geometric shapes after applying transformations.

a. Identify a translation, rotation, or a reflection of a geometric shape.

b. Recognize that 90°, 180°, 270°, and 360° are associated, respectively, with 1/4, 1/2, 3/4, and full turns.

Mathematical language and symbols students should use:
parallel, perpendicular, intersecting lines, right angle, acute angle, obtuse angle, straight angle, circle, radius, diameter, line symmetry, rotational symmetry, coordinate, first quadrant, degree, translate, rotate, reflect, transformation

Exploratory Concepts and Skills
- Analyze results of transformations (e.g., translations, rotations, reflections) on two-dimensional shapes.
- Investigate two-dimensional representations of three-dimensional objects.

Standard III: Students will understand attributes and properties of plane geometric objects and spatial relationships.

Standard IV: **Students will describe relationships among units of measure, use appropriate measurement tools, and use formulas to find area measurements.**

Objective 1: Describe relationships among units of measure for length, capacity, and weight, and determine measurements of angles using appropriate tools.

a. Describe the relative size among metric units of length (i.e., millimeter, centimeter, meter), between metric units of capacity (i.e., milliliter, liter), and between metric units of weight (i.e., gram, kilogram).

b. Describe the relative size among customary units of capacity (i.e., cup, pint, quart, gallon).

c. Estimate and measure capacity using milliliters, liters, cups, pints, quarts, and gallons, and measure weight using grams and kilograms.

d. Recognize that angles are measured in degrees and develop benchmark angles (e.g., 45°, 60°, 120°) using 90° angles to estimate angle measurement.

e. Measure angles using a protractor or angle ruler.

Objective 2: Recognize and describe area as a measurable attribute of two-dimensional shapes and calculate area measurements.

a. Quantify area by finding the total number of same-sized units of area needed to fill the region without gaps or overlaps.

b. Recognize that a square that is 1 unit on a side is the standard unit for measuring area.

c. Develop the area formula for a rectangle and connect it with the area model for multiplication.

d. Develop and use the area formula for a right triangle by comparing with the formula for a rectangle (e.g., two of the same right triangles makes a rectangle).

e. Develop, use, and justify the relationships among area formulas of triangles and parallelograms by decomposing and comparing with areas of right triangles and rectangles.

Standard IV:
Students will describe relationships among units of measure, use appropriate measurement tools, and use formulas to find area measurements.

f. Determine possible perimeters, in whole units, for a rectangle with a fixed area, and determine possible areas when given a rectangle with a fixed perimeter.

Mathematical language and symbols students should use:
millimeter, centimeter, meter, milliliter, liter, gram, kilogram, cup, pint, quart, gallon, area, perimeter

Exploratory Concepts and Skills
- Investigate perimeter of rectangles and squares.
- Investigate area of trapezoids.

Standard V: **Students will interpret and organize collected data to make predictions, answer questions, and describe basic concepts of probability.**

Objective 1: Collect, organize, and display data to answer questions.

a. Identify a question that can be answered by collecting data.

b. Collect, read, and interpret data from tables, graphs, charts, surveys, and observations.

c. Represent data using frequency tables, bar graphs, line plots, and stem and leaf plots.

d. Identify and distinguish between clusters and outliers of a data set.

Objective 2: Describe and predict simple random outcomes.

a. Describe the results of experiments involving random outcomes as simple ratios (e.g., 4 out of 9, 4/9).

b. Conduct simple probability experiments, with and without replacement, record possible outcomes systematically, and display results in an organized way.

c. Use the results of simple probability experiments, with and without replacement, to describe the likelihood of a specific outcome in the future.

Standard V:
Students will interpret and organize collected data to make predictions, answer questions, and describe basic concepts of probability.

Mathematical language and symbols students should use:
data, line plot, line graph, bar graph, stem and leaf plot, cluster, outlier, frequency table, probability

Exploratory Concepts and Skills
- Explore minimum and maximum values for a set of data.
- Explore mean, median, mode, and range.

Utah Elementary Science Core Curriculum

Introduction

Science is a way of deciphering, a process for gaining knowledge and understanding of the natural world. The Science Core Curriculum places emphasis on understanding and using skills. Students should be active learners. It is not enough for students to read about science; they must do science. They should observe, inquire, question, formulate and test hypotheses, analyze data, report, and evaluate findings. The students, as scientists, should have hands–on, active experiences throughout the instruction of the science curriculum.

- Science is a way of deciphering, a process for gaining knowledge and understanding of the natural world.

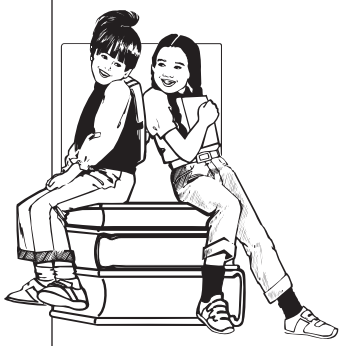
The Elementary Science Core describes what students should know and be able to do at the end of each of the K–6 grade levels. It was developed, critiqued, piloted, and revised by a community of Utah science teachers, university science educators, State Office of Education specialists, scientists, expert national consultants, and an advisory committee representing a wide variety of people from the community. The Core reflects the current philosophy of science education that is expressed in national documents developed by the American Association for the Advancement of Science, the National Academies of Science. This Science Core has the endorsement of the Utah Science Teachers Association. The Core reflects high standards of achievement in science for all students.

Organization of the Elementary Science Core

The Core is designed to help teachers organize and deliver instruction.

The Science Core Curriculum's organization:

- Each grade level begins with a brief course description.
- The INTENDED LEARNING OUTCOMES (ILOs) describe the goals for science skills and attitudes. They are found at the beginning of each grade, and are an integral part of the Core that should be included as part of instruction.
- The SCIENCE BENCHMARKS describe the science content students should know. Each grade level has three to five Science Benchmarks. The ILOs and Benchmarks intersect in the Standards, Objectives and Indicators.



- A STANDARD is a broad statement of what students are expected to understand. Several Objectives are listed under each Standard.
- An OBJECTIVE is a more focused description of what students need to know and be able to do at the completion of instruction. If students have mastered the Objectives associated with a given Standard, they are judged to have mastered that Standard at that grade level. Several Indicators are described for each Objective.
- An INDICATOR is a measurable or observable student action that enables one to judge whether a student has mastered a particular Objective. Indicators are not meant to be classroom activities, but they can help guide classroom instruction.

Eight Guidelines Were Used in Developing the Elementary Science Core

- Reflects the Nature of Science
- Coherent
- Developmentally Appropriate
- Encourages Good Teaching Practices
- Comprehensive
- Feasible
- Useful and Relevant
- Encourages Good Assessment Practices
- The Most Important Goal

Reflects the Nature of Science

Science is a way of deciphering, a process of gaining knowledge and understanding of the natural world. The Core is designed to produce an integrated set of Intended Learning Outcomes (ILOs) for students. Please see the Intended Learning Outcomes document for each grade level core.

As described in these ILOs, students will:

1. Use science process and thinking skills.
2. Manifest science interests and attitudes.
3. Understand important science concepts and principles.
4. Communicate effectively using science language and reasoning.
5. Demonstrate awareness of the social and historical aspects of science.
6. Understand the nature of science.

Coherent

The Core has been designed so that, wherever possible, the science ideas taught within a particular grade level have a logical and natural connection with each other and with those of earlier grades. Efforts have also been made to select topics and skills that integrate well with one another and with other subject areas appropriate to grade level. In addition, there is an upward articulation of science concepts, skills, and content. This spiraling is intended to prepare

students to understand and use more complex science concepts and skills as they advance through their science learning.

Developmentally Appropriate

The Core takes into account the psychological and social readiness of students. It builds from concrete experiences to more abstract understandings. The Core describes science language students should use that is appropriate to each grade level. A more extensive vocabulary should not be emphasized. In the past, many educators may have mistakenly thought that students understood abstract concepts (such as the nature of the atom), because they repeated appropriate names and vocabulary (such as electron and neutron). The Core resists the temptation to tell about abstract concepts at inappropriate grade levels, but focuses on providing experiences with concepts that students can explore and understand in depth to build a foundation for future science learning.

Encourages Good Teaching Practices

It is impossible to accomplish the full intent of the Core by lecturing and having students read from textbooks. The Elementary Science Core emphasizes student inquiry. Science process skills are central in each standard. Good science encourages students to gain knowledge by doing science: observing, questioning, exploring, making and testing hypotheses, comparing predictions, evaluating data, and communicating conclusions. The Core is designed to encourage instruction with students working in cooperative groups. Instruction should connect lessons with students' daily lives. The Core directs experiential science instruction for all students, not just those who have traditionally succeeded in science classes. The vignettes listed on the "Utah Science Home Page" at http://www.usoe.k12.ut.us/curr/science for each of the Core standards provide examples, based on actual practice, that demonstrate that excellent teaching of the Science Core is possible.

Comprehensive

The Elementary Science Core does not cover all topics that have traditionally been in the elementary science curriculum; however, it does provide a comprehensive background in science. By emphasizing depth rather than breadth, the Core seeks to empower students rather than intimidate them with a collection of isolated and eminently forgettable facts. Teachers are free to add related concepts and skills, but they are expected to teach all the standards and objectives specified in the Core for their grade level.

Feasible

Teachers and others who are familiar with Utah students, classrooms, teachers, and schools have designed the Core. It can be taught with easily obtained resources and materials. A Teacher Resource Book (TRB) is available for elementary grades and has sample lessons on each topic for each grade level. The TRB is a document that will grow as teachers add exemplary lessons aligned with the new Core. The middle grade levels have electronic textbooks available at the Utah State Office of Education's "Utah Science Home Page" at http://www.usoe.k12.ut.us/curr/science.

Useful and Relevant

This curriculum relates directly to student needs and interests. It is grounded in the natural world in which we live. Relevance of science to other endeavors enables students to transfer skills gained from science instruction into their other school subjects and into their lives outside the classroom.

Encourages Good Assessment Practices

Student achievement of the standards and objectives in this Core are best assessed using a variety of assessment instruments. One's purpose should be clearly in mind as assessment is planned and implemented. Performance tests are particularly appropriate to evaluate student mastery of science processes and problem-solving skills. Teachers should use a variety of classroom assessment approaches in conjunction with standard assessment instruments to inform their instruction. Sample test items, keyed to each Core Standard, may be located on the Utah Science Home Page. Observation of students engaged in science activities is highly recommended as a way to assess students' skills as well as attitudes in science. The nature of the questions posed by students provides important evidence of students' understanding of science.

The Most Important Goal

Elementary school reaches the greatest number of students for a longer period of time during the most formative years of the school experience. Effective elementary science instruction engages students actively in enjoyable learning experiences. Science instruction should be as thrilling an experience for a child as seeing a rainbow, growing a flower, or holding a toad. Science is not just for those who have traditionally succeeded in the subject, and it is not just for those who will choose science–related careers. In a world of rapidly expanding knowledge and technology, all students must gain the skills they will need to understand and function responsibly and successfully in the world. The Core provides skills in a context that enables students to experience the joy of doing science.

Fourth Grade Science Core Curriculum

The theme for the fourth grade Science Core curriculum is **Utah natural history**. Students will learn about Utah environments including: weather, water cycle, rocks, fossils, soils, plants and animals. Understanding the concepts of **cycles** is an essential component of science literacy and is introduced at this grade level. Emphasis should be placed on skills to classify many things. Students should come to value and use science as a process of obtaining knowledge based on observable evidence, and their curiosity should be encouraged and sustained as they develop the abilities associated with inquiry in science.

- Personal relevance of science in students' lives is always an important part of helping students to value science, and should be emphasized at this grade level.

Good science instruction requires that attention be paid to providing students with hands–on science investigations in which student inquiry is an important goal. Their curiosity should be encouraged and sustained. Teachers should provide opportunities for all students to experience many things. Fourth graders should feel the excitement of a rainstorm, hunt for fossils in rocks, observe the patterns in a spider web, and teach their parents to recognize the song of the lark. They should have many opportunities to observe and predict, to infer, and to classify. They should come to enjoy science as a process of learning about their world.

Science Core concepts should be integrated with concepts and skills from other curriculum areas. Reading, writing, and mathematics skills should be emphasized as integral to the instruction of science. Technology issues and the nature of science are significant components of this Core. Personal relevance of science in students' lives is always an important part of helping students to value science and should be emphasized at this grade-level.

This Core was designed using the American Association for the Advancement of Science's *Project 2061: Benchmarks For Science Literacy* and the National Academy of Science's *National Science Education Standards* as guides to determine appropriate content and skills.

The fourth grade Science Core has three online resources designed to help with classroom instruction; they include *Teacher Resource Book*—a set of lesson plans, assessment items, and science information specific to fourth grade; the *Sci-ber Text*—an electronic science text book specific to the Utah Core; and the science test item pool. This pool includes multiple choice questions, performance tasks, and

interpretive items aligned to the standards and objectives of the fourth grade Science Core. These resources are all available on the Utah Science Home Page. http://www.usoe.k12.ut.us/curr/science

SAFETY PRECAUTIONS:

The hands–on nature of this science curriculum increases the need for teachers to use appropriate precautions in the classroom and field. Teachers must adhere to the published guidelines for the proper use of animals, equipment, and chemicals in the classroom. These guidelines are available on the Utah Science Home Page.

Intended Learning Outcomes for Fourth Grade Science

The Intended Learning Outcomes (ILOs) describe the skills and attitudes students should learn as a result of science instruction. They are an essential part of the Science Core Curriculum and provide teachers with a standard for evaluation of student learning in science. Instruction should include significant science experiences that lead to student understanding using the ILOs.

- Instruction should include significant science experiences that lead to student understanding using the ILOs.

The main intent of science instruction in Utah is that students will value and use science as a process of obtaining knowledge based upon observable evidence.

By the end of Fourth Grade students will be able to:

1. **Use Science Process and Thinking Skills**
   a. Observe simple objects and patterns and report their observations.
   b. Sort and sequence data according to a given criterion.
   c. Make simple predictions and inferences based upon observations.
   d. Compare things and events.
   e. Use instruments to measure length, temperature, volume, and weight using appropriate units.
   f. Conduct a simple investigation when given directions.
   g. Develop and use simple classification systems.
   h. Use observations to construct a reasonable explanation.
2. **Manifest Scientific Attitudes and Interests**
   a. Demonstrate a sense of curiosity about nature.
   b. Voluntarily read or look at books and other materials about science.
   c. Pose questions about objects, events, and processes.
3. **Understand Science Concepts and Principles**
   a. Know science information specified for their grade level.
   b. Distinguish between examples and non-examples of science concepts taught.
   c. Explain science concepts and principles using their own words and explanations.
4. **Communicate Effectively Using Science Language and Reasoning**

a. Record data accurately when given the appropriate form and format (e.g., table, graph, chart).
b. Report observation with pictures, sentences, and models.
c. Use scientific language appropriate to grade level in oral and written communication.
d. Use available reference sources to obtain information.

Fourth Grade Science Standards

Science Benchmark

Matter on Earth cycles from one form to another. The cycling of matter on Earth requires energy. The cycling of water is an example of this process. The sun is the source of energy for the water cycle. Water changes state as it cycles between the atmosphere, land, and bodies of water on Earth.

Standard I: Students will understand that water changes state as it moves through the water cycle.

Standard I: Students will understand that water changes state as it moves through the water cycle.

Objective 1: Describe the relationship between heat energy, evaporation, and condensation of water on Earth.

a. Identify the relative amount and kind of water found in various locations on Earth (e.g., oceans have most of the water, glaciers and snowfields contain most fresh water).

b. Identify the sun as the source of energy that evaporates water from the surface of Earth.

c. Compare the processes of evaporation and condensation of water.

d. Investigate and record temperature data to show the effects of heat energy on changing the states of water.

Objective 2: Describe the water cycle.

a. Locate examples of evaporation and condensation in the water cycle (e.g., water evaporates when heated and clouds or dew forms when vapor is cooled).

b. Describe the processes of evaporation, condensation, and precipitation as they relate to the water cycle.

c. Identify locations that hold water as it passes through the water cycle (e.g., oceans, atmosphere, fresh surface water, snow, ice, and ground water).

d. Construct a model or diagram to show how water continuously moves through the water cycle over time.

e. Describe how the water cycle relates to the water supply in your community.

Science language students should use:

vapor, precipitation, evaporation, clouds, dew, condensation, temperature, water cycle

Science Benchmark

Weather describes conditions in the atmosphere at a certain place and time. Water, energy from the sun, and wind create a cycle of changing weather. The sun's energy warms the oceans and lands at Earth's surface, creating changes in the atmosphere that cause the weather. The temperature and movement of air can be observed and measured to determine the effect on cloud formation and precipitation. Recording weather observations provides data that can be used to predict future weather conditions and establish patterns over time. Weather affects many aspects of people's lives.

Standard II: Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

Standard II: Students will understand that the elements of weather can be observed, measured, and recorded to make predictions and determine simple weather patterns.

Objective 1: Observe, measure, and record the basic elements of weather.

a. Identify basic cloud types (i.e., cumulus, cirrus, stratus clouds).

b. Observe, measure, and record data on the basic elements of weather over a period of time (i.e., precipitation, air temperature, wind speed and direction, and air pressure).

c. Investigate evidence that air is a substance (e.g., takes up space, moves as wind, temperature can be measured).

d. Compare the components of severe weather phenomena to normal weather conditions (e.g., thunderstorm with lightning and high winds compared to rainstorm with rain showers and breezes).

Objective 2: Interpret recorded weather data for simple patterns.

a. Observe and record effects of air temperature on precipitation (e.g., below freezing results in snow, above freezing results in rain).

b. Graph recorded data to show daily and seasonal patterns in weather.

c. Infer relationships between wind and weather change (e.g., windy days often precede changes in the weather; south

winds in Utah often precede a cold front coming from the north).

Objective 3: Evaluate weather predictions based upon observational data.

a. Identify and use the tools of a meteorologist (e.g., measure rainfall using rain gauge, measure air pressure using barometer, measure temperature using a thermometer).

b. Describe how weather and forecasts affect people's lives.

c. Predict weather and justify prediction with observable evidence.

d. Evaluate the accuracy of student and professional weather forecasts.

e. Relate weather forecast accuracy to evidence or tools used to make the forecast (e.g., feels like rain vs. barometer is dropping).

Science language students should use:

atmosphere, meteorologist, freezing, cumulus, stratus, cirrus, air pressure, thermometer, air temperature, wind speed, forecast, severe, phenomena, precipitation, seasonal, accuracy, barometer, rain gauge, components

Science Benchmark

Earth materials include rocks, soils, water, and gases. Rock is composed of minerals. Earth materials change over time from one form to another. These changes require energy. Erosion is the movement of materials and weathering is the breakage of bedrock and larger rocks into smaller rocks and soil materials. Soil is continually being formed from weathered rock and plant remains. Soil contains many living organisms. Plants generally get water and minerals from soil.

Standard III: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Standard III: Students will understand the basic properties of rocks, the processes involved in the formation of soils, and the needs of plants provided by soil.

Objective 1: Identify basic properties of minerals and rocks.

a. Describe the differences between minerals and rocks.

b. Observe rocks using a magnifying glass and draw shapes and colors of the minerals.

c. Sort rocks by appearance according to the three basic types: sedimentary, igneous and metamorphic (e.g., sedimentary—rounded-appearing mineral and rock particles that are cemented together, often in layers; igneous—with or without observable crystals that are not in layers or with or without air holes or glasslike; metamorphic—crystals/minerals, often in layers).

d. Classify common rocks found in Utah as sedimentary (i.e., sandstone, conglomerate, shale), igneous (i.e., basalt, granite, obsidian, pumice) and metamorphic (i.e., marble, gneiss, schist).

Objective 2: Explain how the processes of weathering and erosion change and move materials that become soil.

a. Identify the processes of physical weathering that break down rocks at Earth's surface (i.e., water movement, freezing, plant growth, wind).

b. Distinguish between weathering (i.e., wearing down and breaking of rock surfaces) and erosion (i.e., the movement of materials).

c. Model erosion of Earth materials and collection of these materials as part of the process that leads to soil (e.g., water moving sand in a playground area and depositing this sand in another area).

d. Investigate layers of soil in the local area and predict the sources of the sand and rocks in the soil.

Objective 3: Observe the basic components of soil and relate the components to plant growth.

a. Observe and list the components of soil (i.e., minerals, rocks, air, water, living and dead organisms) and distinguish between the living, nonliving, and once living components of soil.

b. Diagram or model a soil profile showing topsoil, subsoil, and bedrock, and how the layers differ in composition.

c. Relate the components of soils to the growth of plants in soil (e.g., mineral nutrients, water).

d. Explain how plants may help control the erosion of soil.

e. Research and investigate ways to provide mineral nutrients for plants to grow without soil (e.g., grow plants in wet towels, grow plants in wet gravel, grow plants in water).

Science language students should use:

mineral, weathering, erosion, sedimentary, igneous, metamorphic, topsoil, subsoil, bedrock, organism, freeze, thaw, profile, nonliving, structural support, nutrients

Science Benchmark

Fossils are evidence of living organisms from the past and are usually preserved in sedimentary rocks. A fossil may be an impression left in sediments, the preserved remains of an organism, or a trace mark showing that an organism once existed. Fossils are usually made from the hard parts of an organism because soft parts decay quickly. Fossils provide clues to Earth's history. They provide evidence that can be used to make inferences about past environments. Fossils can be compared to one another, to living organisms, and to organisms that lived long ago.

Standard IV: Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.

Standard IV: Students will understand how fossils are formed, where they may be found in Utah, and how they can be used to make inferences.

Objective 1: Describe Utah fossils and explain how they were formed.

a. Identify features of fossils that can be used to compare them to living organisms that are familiar (e.g., shape, size and structure of skeleton, patterns of leaves).

b. Describe three ways fossils are formed in sedimentary rock (i.e., preserved organisms, mineral replacement of organisms, impressions or tracks).

c. Research locations where fossils are found in Utah and construct a simple fossil map.

Objective 2: Explain how fossils can be used to make inferences about past life, climate, geology, and environments.

a. Explain why fossils are usually found in sedimentary rock.

b. Based on the fossils found in various locations, infer how Utah environments have changed over time (e.g., trilobite fossils indicate that Millard County was once covered by a large shallow ocean; dinosaur fossils and coal indicate that Emery and Uintah County were once tropical and swampy).

c. Research information on two scientific explanations for the extinction of dinosaurs and other prehistoric organisms.

d. Formulate questions that can be answered using information gathered on the extinction of dinosaurs

Science language students should use:

infer, environments, climate, dinosaur, preserved, extinct, extinction, impression, fossil, prehistoric, mineral, organism, replacement, trilobite, sedimentary, tropical

Science Benchmark

Utah has diverse plant and animal life that is adapted to and interacts in areas that can be described as wetlands, forests, and deserts. The characteristics of the wetlands, forests, and deserts influence which plants and animals survive best there. Living and nonliving things in these areas are classified based on physical features.

Standard V: Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Standard V:
Students will understand the physical characteristics of Utah's wetlands, forests, and deserts and identify common organisms for each environment.

Objective 1: Describe the physical characteristics of Utah's wetlands, forests, and deserts.

a. Compare the physical characteristics (e.g., precipitation, temperature, and surface terrain) of Utah's wetlands, forests, and deserts.

b. Describe Utah's wetlands (e.g., river, lake, stream, and marsh areas where water is a major feature of the environment) forests (e.g., oak, pine, aspen, juniper areas where trees are a major feature of the environment), and deserts (e.g., areas where the lack of water provided an environment where plants needing little water are a major feature of the environment).

c. Locate examples of areas that have characteristics of wetlands, forests, or deserts in Utah.

d. Based upon information gathered, classify areas of Utah that are generally identified as wetlands, forests, or deserts.

e. Create models of wetlands, forests, and deserts.

Objective 2: Describe the common plants and animals found in Utah environments and how these organisms have adapted to the environment in which they live.

a. Identify common plants and animals that inhabit Utah's forests, wetlands, and deserts.

b. Cite examples of physical features that allow particular plants and animals to live in specific environments (e.g., duck has webbed feet, cactus has waxy coating).

c. Describe some of the interactions between animals and plants of a given environment (e.g., woodpecker eats insects that live on trees of a forest, brine shrimp of the Great Salt Lake eat algae and birds feed on brine shrimp).

d. Identify the effect elevation has on types of plants and animals that live in a specific wetland, forest, or desert.

e. Find examples of endangered Utah plants and animals and describe steps being taken to protect them.

Objective 3: Use a simple scheme to classify Utah plants and animals.

a. Explain how scientists use classification schemes.

b. Use a simple classification system to classify unfamiliar Utah plants or animals (e.g., fish/amphibians/reptile/bird/mammal, invertebrate/vertebrate, tree/shrub/grass, deciduous/conifers).

Objective 4: Observe and record the behavior of Utah animals.

a. Observe and record the behavior of birds (e.g., caring for young, obtaining food, surviving winter).

b. Describe how the behavior and adaptations of Utah mammals help them survive winter (e.g., obtaining food, building homes, hibernation, migration).

c. Research and report on the behavior of a species of Utah fish (e.g., feeding on the bottom or surface, time of year and movement of fish to spawn, types of food and how it is obtained).

d. Compare the structure and behavior of Utah amphibians and reptiles.

e. Use simple classification schemes to sort Utah's common insects and spiders.

Science language students should use:

wetland, forest, desert, adaptation, deciduous, coniferous, invertebrate, vertebrate, bird, amphibian, reptile, fish, mammal, insect, hibernation, migration

Common plants:

sagebrush, pinyon pine, Utah juniper, spruce, fir, oak brush, quaking aspen, cottonwood, cattail, bulrush, prickly pear cactus

Common animals:

jackrabbit, cottontail rabbit, red fox, coyote, mule deer, elk, moose, cougar, bobcat, deer mouse, kangaroo rat, muskrat, beaver, gopher snake, rattlesnake, lizard, tortoise, frog, salamander, red–tailed hawk, barn owl, lark, robin, pinyon jay, magpie, crow, trout, catfish, carp, grasshopper, ant, moth, butterfly, housefly, bee, wasp, pill bug, millipede

Facilitated

Activities

Name _____ District _____

Quadrant Partner

1.	2.
3.	4.

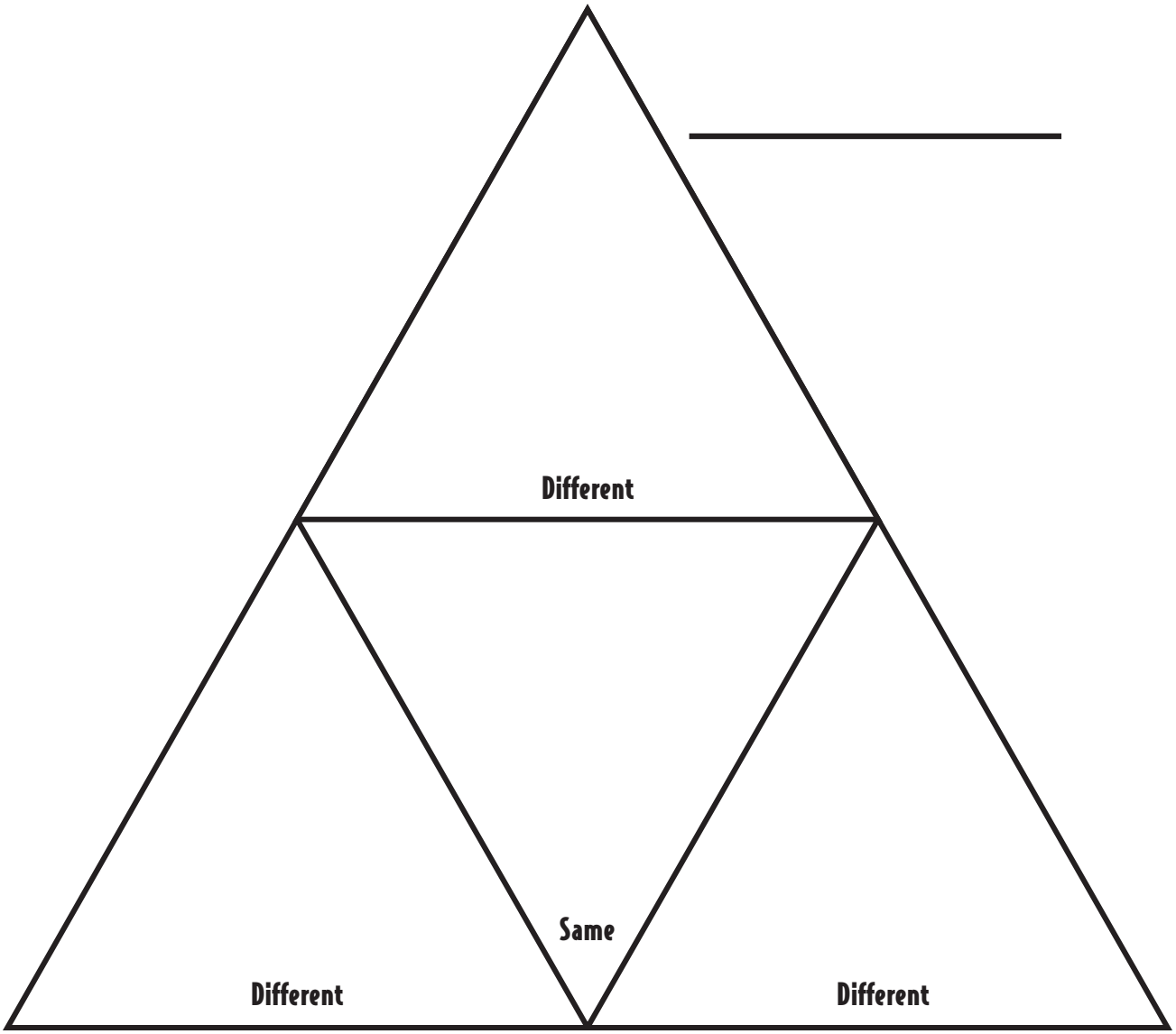
Name _____ Date _____

Compare and Contrast

How Are They Alike?

How Are They Different?	How Are They Different?	How Are They Different?

Triangle Compare and Contrast



Name _____ Date _____

Rectangle Compare and Contrast

_____ _____

Different	Same	Different

Science Journaling Rubric

	4	3	2	1
Organization & Presentation	- Main idea clearly evident - Ideas supported by information and logic - Effective use of text structures to communicate information - Conclusion	- Main idea presented - Ideas are presented, but need more clarification - Conclusions are somewhat logical - Text structures evident	- Main idea stated but unclear - Ideas are either inaccurate or missing - Inappropriate conclusions - Text structures show misconceptions	- No main idea - Much information missing - Little effort evident - No text structures or used incorrectly
Use of Science Language	Consistent use of appropriate science language and terminology	Uses appropriate science language with minor errors	Partial use of science language (3+errors) or terminology	Inaccurate use of science language and terminology
Science Content	- Accurate and complete - Interesting with information in many areas - Makes connections	- Accurate with minor mistakes - Connections are evident but show minor growth or misconceptions	- Information is somewhat complete - Shows few connections	- Inaccurate science - No connections
Conventions	- Journal shows attention to spelling capitalization Careful, detailed - Excellent	- Journal shows minor errors that do not prevent reader from understanding content - Good	- Journal shows many errors, but some effort to try that is evident in reading - Fair	- Journal shows little effort or attention to detail or proof-reading - Confusing to read

Math Journal Rubric

NEATNESS	5 All pages are neat. Appropriate spacing is used. Handwriting is legible. Drawings are neat. No doodling.	3 Some pages are neat. Spacing is used. Handwriting is somewhat legible. Drawings are understandable. Little or no doodling.	1 Messy hard to read. Lots of doodling.
ORDER	5 All notes, activities, and assignments are clearly marked (using capital letters and underlines) and dated. Each section is in the correct order.	3 Some notes, activities, and assignments are clearly marked (using capital letters and underlines) and dated. Each section is in the correct order.	1 No order. Things are hard to find.
COMPLETENESS	5 All notes, activities, and assignments are completed.	3 Some notes, activities, and assignments are completed.	1 Few notes, activities, and assignments are completed.

Total Points: _____

Comments: _____

_____

_____

Construction Scoring Rubrics

What is a Rubric?

- It is a tool developed by teachers to assess students' understanding/performance.
- It lists the tasks to be evaluated and the specific criteria used to evaluate each task.
- It is more than a simple check list; it describes the levels of quality for each task.

Why Use a Rubric?

- Rubrics are used when assessments are subjective.
- Rubrics make instructors' expectations clear to students.
- Rubrics show students how to meet expectations.
- Rubrics help students evaluate the quality of their work.
- Rubrics improve the consistency and objectivity of grading.
- Rubrics may reduce the time it takes to grade.

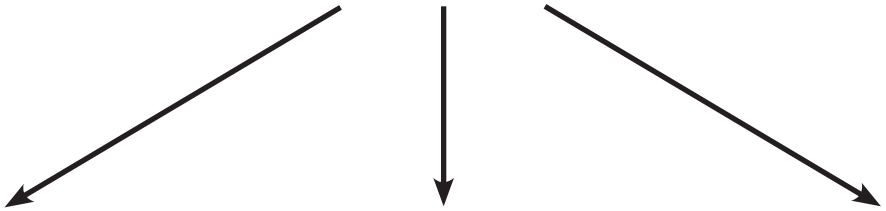
How to Create a Rubric:

- Record the performance objectives.
- Identify the tasks.
- Identify the levels of quality.
- Assign a point value to each level.
- Identify the criteria for each level.
- Create the rubric table.

Differentiating Instruction

How a teacher responds to individual learning need is determined by basic principles of differentiation

Differentiation Principles



Appropriate Task Assignment | Flexible Groups | Formative Assessment Practices

Differentiate Instruction Based On:

Content — Process — Product

While Aligning Students, Consider

Readiness — Interests — Learning Style

Use Multiple Delivery Techniques and Strategies Such As

Tool Bag
Jig Saw
Varied Texts
Literature Circles

Multiple Intelligences/Learning Styles

Children think, learn, and create in a myriad of different ways. Howard Gardner's model of multiple intelligences recognizes the broad range of talents and learning styles we find in our students. Within his model, Gardner identified and categorized eight different intelligences: verbal/linguistic, logical/mathematical, bodily/kinesthetic, intrapersonal, interpersonal, musical/rhythmic, visual/spatial, and naturalistic. According to Gardner, every child possesses each of these intelligences, but some are developed more than others, depending on the individual. Teachers can take these categories and differentiate curriculum through the preparation of activities that nurture these intelligences in students. Indeed, the development of each child's potential is directly influenced by how effectively teachers match what students learn with how they learn (their own particular intelligences).

It is recommended that teachers use the eight multiple intelligences as a springboard to create activities that challenge students to take control of their own learning. Making students aware of the different intelligences will help them identify how they learn best and which methods challenge them. Teachers can target activities that lead students to enhance both their strengths and weaknesses.

Indeed, educators can think of multiple intelligences as a philosophy of how children learn. University of California—Riverside's Sue Teele describes the goal of Gardner's model in this way: "Multiple intelligences provide for different windows into the same room. We need to unleash the creative potential in all our schools in order to open as many windows as possible for every student in every classroom to succeed . . .the future mandates that we all move forward together in a way that builds on both our mutual strengths and respects our unique differences."

Teele's research suggests that certain intelligences are stronger in students, depending on their stages of development. Using a survey she developed, the "Teele Inventory for Multiple Intelligences". Sue studied the learning preferences of more than 6,000 students. Her findings revealed that the verbal/linguistic intelligence is strongest in students in kindergarten through third grade. First through fourth grade students show a definite preference for the logical/mathematical intelligence. The visual/spatial and bodily/kinesthetic intelligences are dominant throughout both elementary and middle school. Middle school students also show a preference for the musical/rhythmic and interpersonal intelligences. Based on Teele's findings, elementary school teachers would be well advised to plan lessons that incorporate the use of verbal/linguistic, logical/mathematical, visual/spatial and bodily/kinesthetic activities.

Here are a few considerations for educators as they strive to create activities based on the different learning styles of their students:

- **Change it up.** Educators should choose activities that target varied intelligences. Since teachers tend to plan lessons and activities that fit their own learning preferences, it's important for them to self-assess and to be sure that all of the intelligences are being represented.
- **Be clear**. When differentiating the "product," teachers need to be sure that students have clear directions (task cards, or posted instructions). Also, routines/procedures should be

established for students so they know how/where to find materials and who/when to ask for help.

- **Be realistic**. It's not necessary or appropriate for teachers to use all eight intelligences in every lesson. During the planning phase, the Core Curriculum and unique needs of the students should be considered to determine which two or three to incorporate.
- **Remember to reflect**. Best practice suggests that after trying something new, professionals take time to reflect, including notes of what to retain and what to refine.
- **All in good time.** It can be overwhelming for teachers to create activities that incorporate the multiple intelligences in every single lesson for every content area. Common sense suggests to start with "baby steps" and consult with colleagues for ideas throughout the process.
- **Communicate with parents**. Both students and their parents will appreciate the insights that come from recognizing and putting a name to their unique learning styles. In fact, teachers can invite parents to help students identify their preferences by sending home a Learning Preferences Survey to be completed by students and parents together (each horizontal row represents a learning style/intelligence).

References:

Tomlinson, C.A. (1999). *The Differentiated Classroom*. (p. 83). Alexandria, VA: ASCD.

Conklin, W. (2007). *Applying Differentiation Strategies*. (pp. 149-202). Huntington Beach, CA: Shell Education.

Teele, S. (1994). Redesigning the educational system to enable all students to succeed. Doctoral dissertation, University of California—Riverside.

Resources:

http://www.thomasarmstrong.com/multiple_intelligences.htm

http://en.wikipedia.org/wiki/Multiple_Intelligences

Gardner's Eight Multiple Intelligences

Intelligence	Student Likes	Student Needs
Verbal/Linguistic "word smart" The student thinks in words.	Words: writing, reading, playing word games, telling interesting stories	journals, books, writing materials
Logical/Mathematical "number/reasoning smart" The student thinks by reasoning.	Numbers or logic: figuring out problems, doing puzzles, experimenting, calculating	science supplies, trips to museums, math manipulatives
Visual/Spatial "picture smart" The student thinks in pictures.	Pictures: drawing, designing, doodling	art supplies, building materials, video equipment, puzzles
Bodily/Kinesthetic "body smart" The student thinks by using his/her body.	A physical experience: dancing, moving, jumping, running, touching	movement, sports, theater, physical games, hands-on activities
Rhythmic/Musical "music smart" The student thinks in melodies and rhythms.	Music: listening to music, making own music, tapping to the rhythm, singing	musical instruments, concerts, karaoke machine
Interpersonal "people smart" The student thinks by talking about his/her ideas to others.	A social experience: organizing events, being the leader, partying, mediating between friends	time with friends, group projects, social events
Intrapersonal "self-smart" The student keeps his/her thoughts to him/herself.	Self-reflection: setting goals, mediating, daydreaming, quiet places	time alone, individualized projects
Naturalist "nature smart" The student thinks by classifying.	An experience in the natural world: studying anything in nature including rocks, animals, plants, and the weather	time outside, nature hikes, telescopes, binoculars, notebooks for classification

Learning Preferences Survey

Dear Parents/Guardians,

It is an honor to be teaching your child, along with a whole class of unique and wonderful fourth-graders! Knowing my students' learning styles will help me plan and prepare learning experiences to enhance their natural talents/interests and to encourage the development of additional skills.

Please take a moment to complete this survey with your child. Thank you for your time. It is a pleasure to work with you!

Sincerely,

Directions: Read each box. Highlight with a crayon/pen/marker to identify the ones your child likes.

reading stories	writing stories	telling stories	spelling	doing word searches	word games
math problems	counting	playing checkers	measuring things	making graphs	science experiments
puzzles	drawing	painting	making sculptures	looking at maps	building blocks
playing sports	hiking	acting	moving around	dancing	running
playing instruments	humming tunes	writing songs	listening to music	singing	clapping rhythms
playing games with others	group work	being the leader	talking to people	talking on the phone	planning parties
keeping a journal	setting goals	quiet time for thinking	time alone	reading alone	daydreaming
animals	nature	learning about weather	watching animals	the outdoors	plants

Tiered Activities

Using tiered lessons is a way for teachers to ensure that all students, regardless of ability level or learning style, progress towards mastery of learning goals and objectives. Tiered assignments, also known as scaffolding, allow for differing levels of readiness and performance levels. The entire class works toward the same essential understanding (parallel tasks) but their paths to that goal depend upon their abilities and learning styles (varied levels of depth and varied degrees of support).

The following are guidelines for planning tiered lessons/assessments. Teachers should:

1. Using the Core Curriculum, pick a concept or skill that needs to be learned (e.g., "What's the ultimate measurable objective?").
2. Think of an activity that matches the objective.
3. Use pre-assessment data to determine the individual needs of the students. Consider students performing above grade level, students below grade level, English Language Learners, and students with varying learning style preferences (multiple intelligences).
4. Take another look at the selected activity. Target its complexity to be appropriate for on-grade-level learners.
5. Modify the activity or assessment to meet the needs of the other learners in the class. Within one activity, there will be several tiers to meet the wide range of student needs.
6. Seek consultation from the specialists in the school as well as fellow colleagues.
7. Teach the activity, including the various tiers.
8. Reflect and refine.

Remember, tiered lessons provide differentiation because of varied levels of complexity, not necessarily because of varied quantities of work. Here are a few considerations for educators, as they implement use of tiered activities to scaffold for student learning:

- Just because students are above grade level, does not mean that they should be given more work.
- Just because students are below grade level, does not mean that they should be given less work.
- All tiered activities should be interesting and appealing.
- All tasks should provide a challenge.

Tomlinson, C.A. (1999). The Differentiated Classroom. (p. 83). Alexandria, VA: ASCD.

Conklin, W. (2007). Applying Differentiation Strategies. (pp. 149-202). Huntington Beach, CA: Shell Education.

McCombs, B.L. (1995). Understanding the keys to motivation to learn. Noteworthy Perspectives: What's Noteworthy on Learners, Learning, and Schooling.

Tic-Tac-Toe Menu

Choose three activities from the menu that will give you a winning game. Check off each activity as you complete it. Draw a straight line through all three when you are finished.

(Mathematical/Logical) Write a mathematical expression that equals the number of hours you have spent in CORE Academy over the years.	(Linguistic/Verbal) Choose a word from either "Science language students should use" or "mathematical language students should use" and use it in a tongue twister that demonstrates your understanding of the word.	(Body/Kinesthetic) Write a fraction addition or subtraction problem that could be acted out or modeled by students.
(Visual/Spatial) Draw a picture with at least 5 angles in it. Measure and record the degrees in each angle.	Free Choice Make up your own activity dealing with CORE Academy.	(Intrapersonal) In your journal list 5 things you have learned this year in CORE Academy that you want to be sure and remember or use this coming year.
(Interpersonal) Working with at least one other person, fill in the blanks to make a CORE Academy joke. 185 _____ go into a bar, the bartender says, "We don't serve _____ in here. The 185 _____ say, "_____."	(Musical) Write a jingle for a CORE Academy TV commercial.	(Naturalistic) Make a list of 6 activities you can use to get your students outside to explore science or math.

RAFT Options

Role	Audience	Format	Topic
Yourself	Your spouse and children	Note attached to the refrigerator door	Job assignments for children, what to fix for lunch, and who to call in case of an emergency while you are at CORE Academy
4th Grade Student	A classmate	Playground discussion	My favorite subject in school
Principal	Teachers at a Faculty meeting	Power Point presentation	The school's end of level testing, and AYP results
Parent	Son or daughter's teacher	Parent teacher conference	My child is so excited about….
The Teacher Next Door	Students	A bulletin board	Purple Monkeys Do Awesome Summersaults
Janitor	Sweeper	Note taped to vacuum	Ms. Brown did science again today….!
First Year Teacher	Self	Journal entry dated the day before school starts for the year	HELP….
Thirty Year Veteran Teacher	Self	Conversation to self on drive to school for the first day of the year	HELP….
Your Child	God	Prayer	Please help mommy/ daddy's school make AYP this year….
Your Spouse	You	Cell phone conversation during CORE Academy session	Johnny did what?!

Tic Menu

Choose one task and complete it, then begin another task of your team's choice.

RAFT Options With your team choose an objective or standard from the math or science CORE and brainstorm as many different Roles, (with accompanying Audience, Format, and Topic,) as you can that apply to the objective. Record your team's ideas in your journal.	Tic-Tac-Toe Menus In your journal, label a page for each of the 8 Multiple Intelligences. With your team, choose an objective or standard from the science or math CORE. Begin writing tasks for each of the intelligences that could be used on a menu.	Menu or RAFT With your team, choose an objective or standard from the science or math core and make a Tic-Tac-Toe Menu or RAFT that could be taken back to your classroom and used next year.

Math IV-1
Activities

Measurement

Angles, Degrees, Protractors...Oh My!

Standard IV:

Student will describe relationships among units of measure, use appropriate measurement tools, and use formulas to find area measurements.

Objective 1:

Describe relationships among units of measure for length, capacity, and weight, and determine measurements of angles using appropriate tools.

Intended Learning Outcomes:

2. Become mathematical problem solvers.
4. Communicate mathematically.

Content Connections:

Math III-1; Recognize angle degree
Oral Language IV-1; Communicate by listening, speaking, and viewing

Math Standard IV

Objective 1

Connections

Background Information

The protractor is an instrument of measurement. A protractor is used to construct and measure angles. The simple protractor is an ancient device used for plotting the position of boats on navigational charts. There are different kinds of protractors, but the one used in elementary school is called a simple protractor. We have units for measuring angles and they are called degrees. These are not the same as temperature degrees, even though the same word is used. The simple protractor looks like a semicircular disk marked with degrees, from 0º to 180º.

Angles are formed when two rays intersect. Angles are measured in degrees. A complete circle measures 360 degrees. If you take a circle and cut it into 360 slices, each of those slices is one degree. Why 360 degrees? Historians believe this is because old calendars, such as the Persian Calendar, used 360 days for a year. When they watched the stars they saw them revolve around the North Star one degree per day. This ancient measurement is still recognized today as the measurement of a circle.

To adequately use and understand using a protractor, students need to have background knowledge of the following vocabulary: angle, acute, obtuse, right, straight, reflex, vertex, and arms.

Students in 4th grade need to recognize benchmark angles:

90 degree angel= ¼ of a circle

180 degree angle = ½ of a circle

270 degree angle = ¾ of a circle

360 degrees = full circle

Research Basis

Van Hiele, P. M. (1999, February). Developing geometric thinking through activities that begin with play. *Teaching Children Mathematics*, 5 (6), 310-316.

"For children, geometry begins with play," writes Pierre van Hiele (1999). He goes on to say that for students to reach the higher levels of geometric thinking, their instruction should still begin with an exploratory phase, gradually building concepts and related language, and culminating in summary activities that help students integrate what they have learned into what they already know."

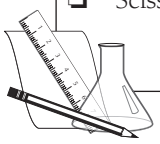
Ernest, P.S. (1994). E*valuation of the effectiveness and implementation of a math manipulatives project*. (Report No. SE-057 682). Nashville, TN: Annual Meeting of the Mid-South Educational Research Association. (ERIC Document Reproduction Service No. ED 391 675).

The purpose of manipulatives would be to allow students to learn a geometric principle in more than one way. In other words, instead of just hearing about a math principle, they also get to see and feel it. The study confirms that students are more willing to participate, and experiment in math projects. Their attitudes towards math improved, thus raising their self-confidence in their math ability.

Invitation to Learn

Materials

- ❑ *Mystery Word*
- ❑ Scissors



Place the strip of pre-printed letters on each student's desk. The students will cut the letters apart and manipulate the letters until they figure out what the mystery word is. Instruct students when they discover the mystery word to write it down on a piece of paper and wait for teacher to verify the word.

R C R P T R T O A O (Protractor)

After all students have discovered the mystery word, protractor, introduce the protractor lesson.

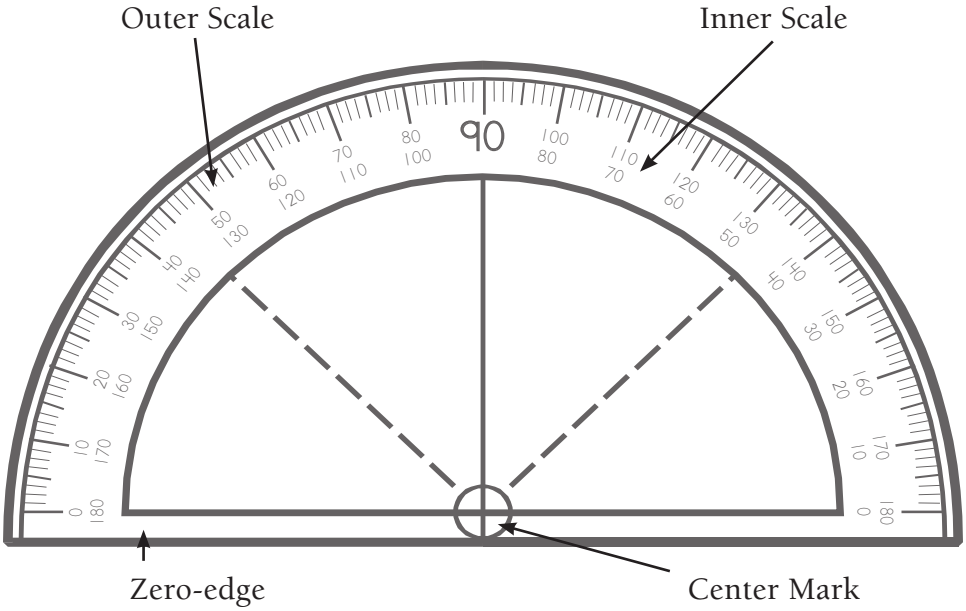
Instructional Procedures

Materials

- ❑ *Label a Protractor*
- ❑ Overhead protractor
- ❑ Overhead projector
- ❑ Math Journal
- ❑ Scissors
- ❑ Glue

Using a Protractor

1. The teacher will demonstrate how to read and label a protractor. (overhead protractor).
2. Cut out preprinted protractor. Glue in math journal.
3. The students will record how to read and label a protractor in their journal.
4. Points to label: outer scale, inner scale, center mark and zero-edge.



Cut out the protractor and place in Math Journals. Divide the page into 4 equal sections. Label the sections with the following headings. Review and discuss how to label. Record directions in journal.

Zero-Edge The zero-edge is always at the same level as the 0 mark.	**Center Mark** The center mark is always at the middle of the zero-edge.
Inner Scale The numbers on the inner edge of the protractor.	**Outer Scale** The numbers on the outer edge of the protractor.

Classroom Protractors

Fourth grade students generally find it difficult to read and calculate the degree marks accurately. A "homemade" protractor (with a dark thread) helps eliminate this problem. Manipulating the thread to lay on the exact degree, helps the students identify the exact degree on the protractor.

Materials

- ❑ *Making My Protractor*
- ❑ Needle
- ❑ Thread
- ❑ Scissors
- ❑ *What's My Angle*

Constructing a Student Protractor

1. Cut out laminated protractor.
2. Thread needle and tie knot at end.
3. Bring needle up through the center mark on the protractor. Tape thread securely in place.
4. Students will manipulate the thread to line up with the angle to be measured.
5. Use the angle worksheet to practice measuring angles.

To Measure an Angle

1. Find the center mark on the straight edge of the protractor.
2. Place the hole over the vertex, or point, of the angle you wish to measure.
3. Line up the zero on the straight edge of the protractor with one of the sides of angle.
4. Find the point where the second side of angle intersects the curved edge of the protractor.
5. Place the thread on the second angle line.
6. Read the number that is written on the protractor at the point of intersection. This is the measurement of the angle in degrees.
7. There are two sets of scales on the protractor, an outer scale and inner scale. The degrees start at 0 on the straight edge, each going in opposite directions. The lines are the same so when naming angles make sure you identify which angle is being measured.

Constructing an Angle

1. Use the straight edge of the protractor to draw a straight line. This line will form one side of your angle.
2. Find the center hole on the straight edge of the protractor.
3. Place the hole over one end point of the line you have drawn.
4. Line up the zero on the straight edge of the protractor with the line.
5. Make a mark at the number on the curved edge of the protractor that corresponds to the desired measure of our angle. For example, mark at 90 for a 90 degree angle
6. Use the straight edge of the protractor to connect the mark to the end point of the first line, forming an angle.

Independent Practice

1. The protractor worksheet *What's My Angle* is given to each student.
2. Students will classify angles as acute, straight, obtuse or right.
3. Guide students in measuring various angles.
4. Record the measurements and type of angle on the worksheet.
5. Group students in pairs to check each other's work.
6. Next, on reverse side of worksheet, students will draw 3 angles to be measured by the other student.
7. Teacher will assess for accuracy.

What's My Name Worth?

1. How much is a first name worth? Calculate the value of your name by identifying angles. Start this activity by showing the class the "angle price list."

   acute angles = 10 cents each

   obtuse angles = 8 cents each

   right angles = 5 cents each

   vertical lines = 3 cents each

   horizontal lines = 2 cents each

   diagonal lines = 1 cent each
2. Each student will use the preprinted alphabet to print his/her first name in capital letters.
3. The student then examines the name for obtuse angles, acute angles, right angles, vertical lines and horizontal lines.
4. Next the student adds the various amounts and comes up with a total.

Example:

J A N E

5 acute angles @ 10 cents each =	$.50
2 obtuse angles @ 8 cents each =	.16
4 right angles @ 5 cents each =	.20
4 vertical lines @ 3 cents each =	.12
4 horizontal lines @ 2 cents each =	.08
1 diagonal lines @ 1 cent each =	.01
	$1.07

Assessment Suggestions

- Students draw and measure angles.
- Formal assessment requiring identifying angle type, degrees, and vocabulary.

Curriculum Extensions/Adaptations/ Integration

- Students make angles using the Semaphore flag system. Semaphore Fun visit: http://en.wikipedia.org/wiki/Image:Semaphore_Yankee.svg
- Students make angles any way they can without using pencil and paper, such as a "people" Clock or drawing/manipulating the hands of a clock.
- Use the price list and find the value of each letter in the alphabet.
- Use a geo-board to construct a figure.
- Use a die to determine the number of sides of a figure. Students who roll a 1 or 2 must roll again. Ten points are awarded for each angle or line the student can list about their figure.
- Instruction is differentiated according to learner needs. The goal is to help all learners meet the intent of the specified learning goal.
    1. For students struggling to identify angles, provide additional pictures of real-life objects with the angles highlighted or bolded in the picture. Have these students identify the type of angle and then show the students a similar object in the classroom. Have each student run a hand along the angle in the picture and then along the angle of the real object.
    2. Other accommodations would be grouping so the student has a "buddy" within the larger group.
    3. Describe/rehearse rules of conduct so the child can be successful.
    4. Allow each student his/her physical "space" within the group.
    5. Pre-teaching vocabulary is especially important for ELL students.

Family Connections

- Have a family scavenger hunt for angles. A prepared list of angles could be given each family member to check off as they find them.
- Look for angles in nature.
- Explore on-line angle activities together.

Additional Resources

Books

Sir Cumference and the Great Kingdom of Angleland: A Math Adventure, by Cindy Neuschander; ISBN-10: 157091169X

Angles (Let's Investigate), by Ted Evans; ISBN-10: 1854354663

Angles are Easy as Pie, by Robert Froman & Byron Barton; ISBN-10: 069000916X

Web sites

Rainforest Maths: http://www.rainforestmaths.com/

Lots of interactive games: http://www.woodlands-junior.kent.sch.uk/maths/shape.htm#Angles

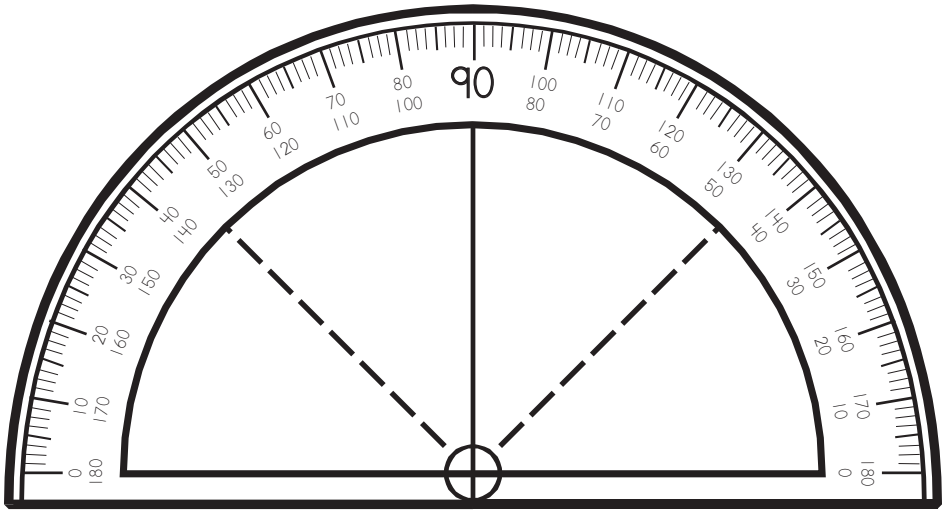
Introduction to Angles: http://www.quia.com/jg/65822.html

Protractor interactive: http://www.amblesideprimary.com/ambleweb/mentalmaths/protractor.html

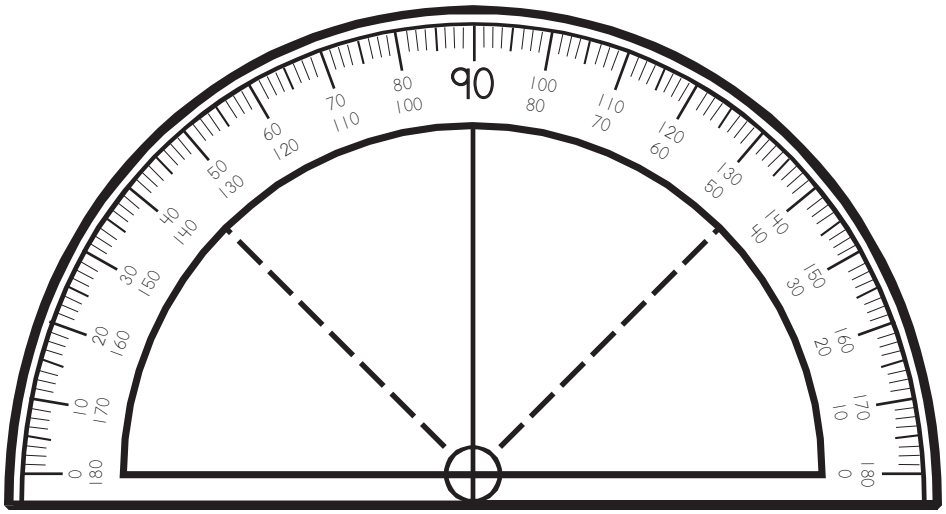
Mystery Word

R	C	R	A	P	T
R	O	T	O		

Label a Protractor



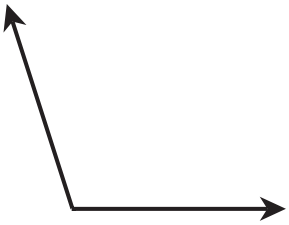
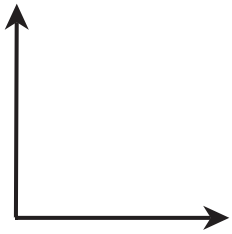
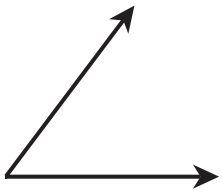
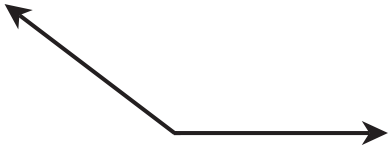
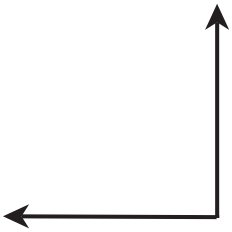
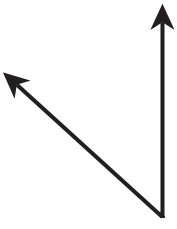
Making My Protractor



Name _____ Date _____

What's My Angle?

Identify the angle. Use a protractor to measure the angle and record.

1.  Angle _____ Degrees _____	2.  Angle _____ Degrees _____
3.  Angle _____ Degrees _____	4.  Angle _____ Degrees _____
5.  Angle _____ Degrees _____	6.  Angle _____ Degrees _____
7.  Angle _____ Degrees _____	8.  Angle _____ Degrees _____

What is My Name Worth?

Angle Letters

Use these letters to find the angles in your name.

A B C D E F G

H I J K L M N

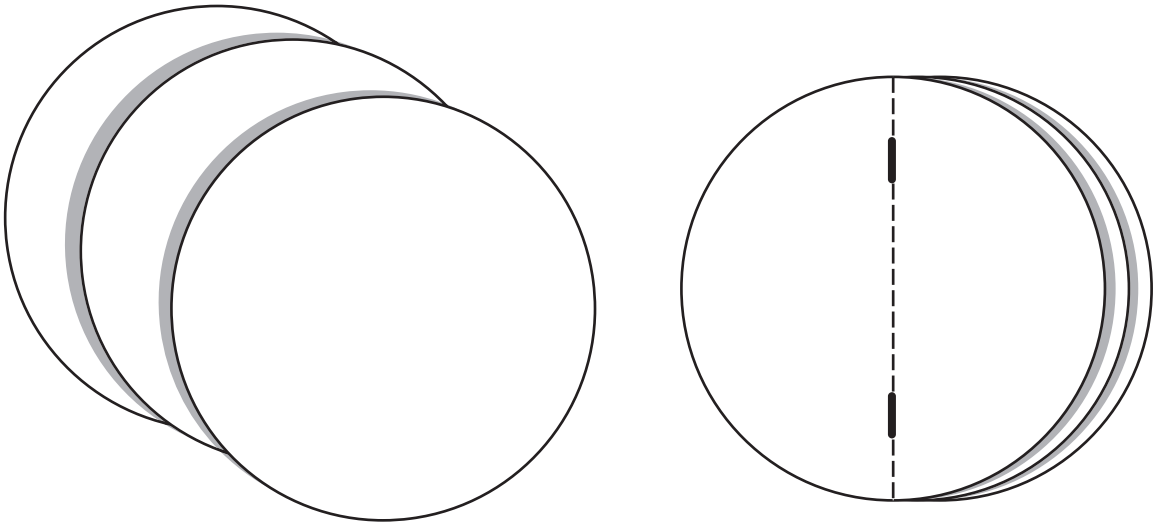
O P Q R S T U

V W X Y Z

$$$ ANGLE CASH $$$		
Acute angle	=	10 cents each
Obtuse angle	=	8 cents each
Right angle	=	5 cents each
Vertical line	=	3 cents each
Horizontal line	=	2 cents each
Diagonal line	=	1 cent each

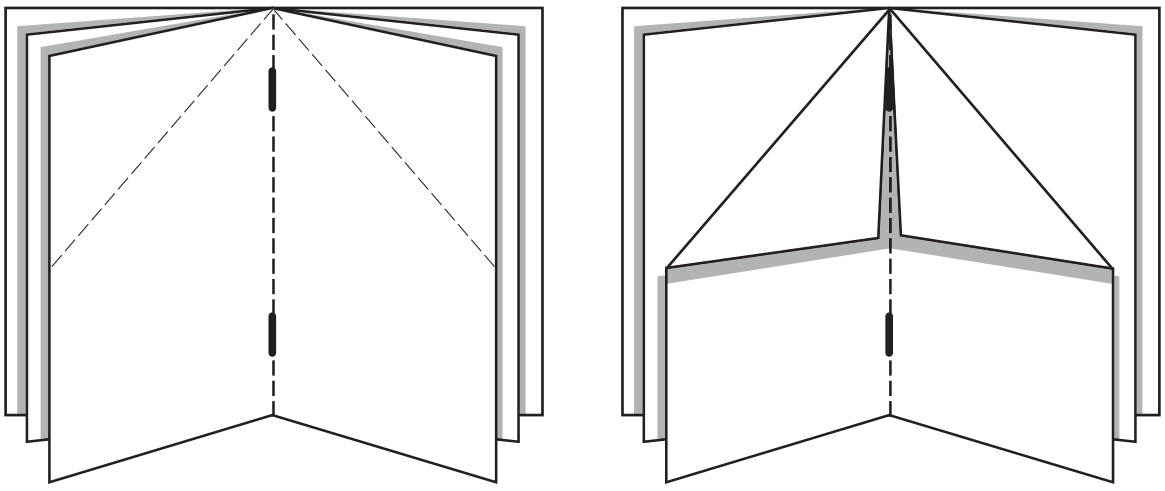
Circle Book in Journal

1. Cut same size circles and stack.
2. Fold the stack in half.
3. Staple in the middle to create journal page.
4. Create small reference book with mathematical vocabulary for topic.



Rectangle Book in Journal

1. Cut same size rectangles and stack.
2. Fold stack in half.
3. Staple in the middle to create journal page.
4. Create small reference book with mathematical vocabulary for topic.



Mountain Man Measurement Rendezvous

Math Standard IV

Objective 1

Connections

Standard IV:

Students will describe relationships among units of measure, use appropriate measurement tools, and use formulas to find area measurements.

Objective 1:

Describe relationships among units of measure for length, capacity and weight, and determine measurements of angles using appropriate tools.

Intended Learning Outcomes:

1. Develop a positive learning attitude toward mathematics.
5. Connect mathematical ideas within mathematics, to other disciplines, and to everyday experiences.

Content Connections:

Social Studies I-2; Utah history

Background Information

The Mountain Man played an important part in the history of the American frontier. The era of the Mountain Man/Trapper lasted about 40 years from 1820 - 1840. They made many contributions to history by exploring the entire western part of the United States. They discovered easier ways to get through the mountains, made maps, kept journals, and served as guides and scouts for pioneers, the army, and the government.

The Mountain Man also introduced the Rendezvous to the history books. Rendezvous were gatherings held each summer where mountain men would meet with fur traders to trade their furs for supplies. The trappers would trade their furs for the "possibles" needed for the coming fur season. "Possibles" were such things as Galena lead for rifle balls, black powder, traps, "rendezvous whisky," coffee, sugar, pemmican, jerky, clothing, blankets, horses and mules and other items that allowed them to live through the coming winter.

The life of a trapper was tough, lonely, and dangerous. The rendezvous gave these mountain men an opportunity to come together to swap stories of the year behind them; test their skills against each other, brawl, drink, and resupply for the coming year.

What kind of measurement would a mountain man have used? It was unlikely that they carried the common measurement tools of the time. In most cases, they did not need precise measurements in their daily activities. They generally used the measurement "tools" that mankind has over time to measure, parts of the human body. For example, the length of the tip of the index finger to the joint is a

"digit" and the width of four fingers is a "palm." The distance from the tip of the thumb to the end of the little finger is a "span." The width of the thumb is about an inch. The distance from the elbow to the tip of the middle finger is called a "cubit." Distance was measured by the length of a person's foot. Three feet equaled about a yard. Longer distances were measured in paces. Two steps is a "pace." These were good enough for their daily activities.

At the time of the mountain men, there were other areas of life and commerce that required more precise measurement. It is likely that at the rendezvous, where commodities were being traded, such as lead for bullets, bottles of whiskey, salt, flour and other commodities, standardized measurements, such as pounds and quarts were no doubt used.

In different times and places in the world, there have been many systems of measurement. Today we use only two systems, the customary system in the United States and the metric system, which is, used almost everywhere else in the world. In all cases, measurement systems are tools that are used to help achieve specific objectives. How precise they are is entirely dependent on how precise they must be to achieve these objectives. The measurement systems necessary for the day-to-day life of the mountain men illustrate these differing needs.

Research Basis

Boulton-Lewis, G. M., Wilss, L. A., & Mutch, S. L. (1996). An analysis of young children's strategies and use of devices of length measurement. Journal of Mathematical Behavior, 15, 329-347

Measurement is one of the principal real-world applications of mathematics. It bridges two critical realms of mathematics: geometry or spatial relations and real numbers. Done well, education in measurement can connect these two realms, each providing conceptual support to the other. Indications are, however, that this potential is usually not realized. U.S. students study geometric measurement less than those in most other countries (National Center for Education Statistics, 1996).

Bonwell, C. C. & Eison, J. A., (1991). Active Learning: Creating Excitement in the Classroom, ASHE-ERIC Higher Education Report No. 1. Washington, D.C.: The George Washington University.

Active learning is simply that—having students engage in some activity that forces them to think about and comment on the information presented. Students won't simply be listening, but will be developing skills in handling concepts in our disciplines. They will analyze, synthesize, and evaluate information in discussion with other students, through asking questions, or through writing.

Invitation to Learn

Invite students to make a list in their journals all of the ways they use measurement in a day. After completing the list, instruct them to mark five items they would not like to live without. Discuss how prevalent "measurement" is in our lives and how almost everything we do involves measurement in some way.

Instructional Procedures

Mountain Man Measurement Rendezvous

The Mountain Man Measurement Rendezvous is a hands on, active learning measurement activity designed to give children the opportunity to demonstrate their measurement skills in a classroom version of a measurement Rendezvous. This activity would be good to have outside. A classroom, gym or hallway could be used if they are available

Students will participate in several classroom Mountain Man Measurement Rendezvous activities where they will apply measurement skills. (The teacher may need to limit the number of the events that can be reasonably completed on the time allotted for this activity.)

1. Lead class in discussion about a Mountain Men Rendezvous. Make connections to Utah History.
2. Explain that students are going to use their measurement skills to see how well they will do in a classroom version of a measurement rendezvous.
3. Give each student a copy of Rendezvous Recording Sheet.
4. Students should refer to the recording sheets while teacher describes procedures and materials for each event.
5. Divide class into pairs or small groups. Set up rules for changing stations so that all groups have enough time to complete each task.
6. Remind students that they will usually get only one try in each event, and they need to record this attempt.
7. Laminate student directions and post them at each station. Each student or pair of students should keep track of their work on *Rendezvous Recording Sheet*.

Materials

- ❑ Pompoms
- ❑ Paper plates
- ❑ Craft sticks
- ❑ Straws
- ❑ Marshmallows
- ❑ Sponge
- ❑ mL measuring container
- ❑ Container for water
- ❑ Bowl
- ❑ Cans
- ❑ Beans
- ❑ Balance
- ❑ Marbles
- ❑ Metric weights
- ❑ Meter and yard sticks
- ❑ Measuring tape
- ❑ Measuring wheel
- ❑ Graph paper
- ❑ Pencil
- ❑ *Rendezvous Event Directions*
- ❑ *Rendezvous Recording Sheet*

Assessment Suggestions

- The teacher will assess the students' understanding of various measurements through observation during the events. The teacher will assess the student's estimation ability and the understanding of different measurements by checking the recording sheet for accuracy.

Curriculum Extensions/Adaptations/ Integration

- Mountain Man Measurement Rendezvous activity could be done using only metric or standard measurement.
- Invite students to make up their own measurement activities and game.

Family Connections

- Students and families can create measurement activities around a different theme, such as a carnival, sports, winter or summer events.
- Bath time provides good opportunity to practice measuring capacity.

Additional Resources

Books

How Tall, How Short, How Far Away, by David A. Adler; ISBN-10 0823416321

Measuring Penny, by Loreen Leedy; ISBN-10 0805065725

It's Probably Penny, by Loreen Leedy; ISBN-10 0805073892

Twelve Snails to One Lizard, by Susan Hightower; ISBN-10 0689804520

Web sites

Rainforest maths (excellent site)- http://www.rainforestmaths.com/

Measurement http://www.teachingmeasures.co.uk/menu.html

Multiple sites: http://www.saskschools.ca/curr_content/byersjmath/geometry/students/coverpg.html

Rendezvous Event Directions

Post these directions at each station.

Jump The Creek

Materials

- Meter Stick

1. With feet on the starting line, long jump as far as possible.
2. Using a meter stick, measure the distance from the starting line to the closest place to the starting line that your body touched.
3. Record.

Grab The Gold

Materials

- Balance scale
- Metric weights
- 2 cups marbles or other similar objects

1. The students will take turns reaching into a container and grabbing as many marbles/objects as possible.
2. The objects grabbed should then be placed on the balance scale. The student should estimate (in grams) how heavy the objects are.
3. The student should then place the gram weights on the other side of the scale until it balances. Record weight.

Wash Day!

Materials

- Large kitchen sponge
- Container with water
- Large bowl
- mL container

1. The student will soak the sponge in a container of water. Wait for it to soak up lots of water.
2. Using only one hand, remove the sponge and hold it over the large bowl. Squeeze the sponge over the empty container.
3. The student will then estimate in mL the amount of water in the second container. Pour the amount in to the measuring container, and then measure in mL and record.

Buffalo Chip Throw

Materials

- Paper plates
- Measuring wheel/measuring tape
- Buffalo chips (paper plates)

1. Student stands at designated line and throws a "buffalo chip" as far as he/she can.
2. Partner uses measuring wheel to measure distance from starting line to where plate landed.
3. Record on recording sheet. Partners reverse places.

I Need New Buckskins!

Materials

- Standard measuring tape or yard stick

1. Measure parts of your body using a string, yarn or measuring tape. If using string, measure body part and then measure string (inches, feet or yards).
2. Record on recording sheet.
3. Measure width of your arm span, wrist to longest finger, length from your waist to floor and circumference of your head!

Stone Throw

Materials

- Measurement wheel or long tape measure
- 6 medium/large pompoms (assorted colors)

1. Student stands at designated line and predicts how far she thinks she can throw the "ball." Record.
2. Throw "ball" and measure actual distance. Leave colored pom-pom where it landed. After all team members have thrown, compare who threw it the shortest or farthest distance.
3. Students work in teams of two. One person throws and the other measures. Reverse roles and record on the recording sheet.

Arrow Challenge

Materials

- Craft stick (previously decorated)
- Measurement wheel or long tape measure.

1. Student stands at a designated line and predicts how many feet/yards he/she can throw the "arrow."
2. Throw the "arrow" overhand. Partner measures actual distance. Students work in teams of two. One person throws and the other measures.
3. Reverse roles and record on recording sheet.
4. Measure with the measurement wheel.

Big Foot Bragging Rights

Materials

- 8 ½ x 11 graph paper/centimeters
- Pencil

1. Student predicts how many square centimeters he thinks his foot is. (This can be done with shoe off or on.) Record.
2. Student places his foot/shoe on the sheet of centimeter paper while partner draws around his foot/shoe.
3. Count number of square centimeters that are inside of the drawing.
4. Record area of foot on recording sheet.

Cache It Or Carry It

Materials

- 5 pounds dried beans
- Three cans, different sizes

1. Students estimate how many beans it will take to fill the largest cooking pot. Record.
2. Scoop beans, cup at the time, emptying it into the "cooking pot". Record actual amount.
3. Next, estimate how many beans will fill the smaller "pot". Record.
4. Repeat scooping and fill the smaller container. Record.

Straight Shooter

Materials:

- Boba Straw
- Mini-Marshmallows
- Measuring tape/measurement wheel

1. Student stands at designated starting line.
2. Squish marshmallow and insert into straw.
3. Shoot the marshmallow by puffing a strong burst of air into the straw.
4. Record on recording sheet.

Name _____ Date _____

Rendezvous Recording Sheet

	My Prediction	Actual Measure
1. Buffalo Chip Throw (measure in Standard)		
2. Grab the Gold (measure in Grams)		
3. Jump the Creek (measure in Standard)		
4. Wash Day! (measure in metric)		
5. Stone Throw (measure in metric)		
6. Arrow Challenge (measure in metric)		
7. Big Foot (measure area in centimeters)		
8. Cache it or carry it! (measure in standard)		
9. I Need New Buckskins! (measure in standard)		
Width of arm span		
Wrist to longest finger		
Circumference of head		
Leg length—waist to floor		
10. Straight Shooting (measure in standard)		

Science I-2

Activities

Water Cycle

Dino Drool

Standard I:

Students will understand that water changes state as it moves through the water cycle.

Objective 2:

Describe the water cycle.

Intended Learning Outcomes:

1. Use science process and thinking skills
2. Communicate effectively using science language and reasoning

Content Connections:

Math V-1; Collect, organize and display data

Science Standard I

Objective 2

Connections

Background Information

Earth's water system is finite; the same water we are drinking today has been cycled over, on, and under Earth's surface for thousands of years. This continual movement of water, the water cycle, collects, purifies and distributes the water we need to live. Because water does move in a never-ending cycle, the water we are using today is the same water prehistoric creatures used for sustenance. The model in this activity illustrates the water cycle on a global level. The total amount of water inside the model is constant, like the total amount of water on Earth is constant.

The model is constructed using three clear two-liter bottles with caps. These bottles will need to be prepared beforehand by removing labels and cutting one bottle just below the curved top, (you can use a drywall screw to make a starter hole for the scissors). Label this bottle "A" with a permanent marker on the side of the bottle. Cut the other bottle just above the curved bottom; label this bottle "B" with a permanent marker on the side of the bottle. Label the third bottle "C." A quarter inch hole should be drilled in one of the bottle lids.

This activity will require a minimum of two 50-60 minute periods.

Research Basis

Ash, D., & Kluger, B. B., (1999). Identifying Inquiry in the K-5 Classroom.

Instructional models engage students in scientific questions, provide opportunities for students to explore those questions, and require students to interpret data to create explanations. Good science inquiry involves learning through direct interaction with materials and phenomena. One important sign of inquiry is the relative level of

control that the students have in determining various aspects of the learning experience.

Marzano, R. J., Pickering, D. J., Pollock, J. E., (2001) *Classroom Instruction That Works: Research-based Strategies for Increasing Student Achievement.* Alexandria, VA: ASCD.

Scientific thinking is enhanced through instructional methods such as identifying similarities and differences; summarizing and note taking; non-linguistic representation; cooperative learning; setting objectives and providing feedback; generating and testing hypotheses; and questions, cues, and advance organizers.

Invitation to Learn

The teacher invites the class to have a drink of water. As the class is sipping their cups of water, the teacher asks 5 students to each open a numbered envelope and read the contents. Each envelope contains a factoid about the water cycle that has previously been discussed in class. The fifth envelope is opened and the student reads aloud from the card, "Mr./Mrs./Ms._____, do you know you are drinking dinosaur drool?" The teacher either pretends to choke or spits out the water in a "dramatic" fashion. "How is this possible?" exclaims the teacher, "It tastes like clean, fresh water, it looks like clean fresh water, it smells like clean fresh water, how did the dino drool get in here? It is time for an investigation!"

Materials

- ❑ *Building a Water Cycle Model*
- ❑ *Fill the Water Cycle Model*
- ❑ *The Water Cycle Process*
- ❑ 2-liter bottles
- ❑ Scissors
- ❑ Transparent tape
- ❑ Cotton strips
- ❑ Potting soil
- ❑ Grass seed
- ❑ Measuring cup
- ❑ Hand shovel
- ❑ Ruler (cm)

Instructional Procedures

1. Introduce this activity of building a water cycle model to the students with a review of evaporation, condensation, and precipitation. Introduce the terms transpiration and percolation and discuss their meanings.
2. Divide the class into groups of 4. Each group will work together to make one model.
3. Give each group a copy of *Building a Water Cycle Model* instruction sheet and instruct the students to follow the written directions.
4. When each team has completed assembling their model, give them a copy of *Fill the Water Cycle Model* instruction sheet.
5. At the conclusion of each team filling their model, give them the *The Water Cycle Process* label handout. Have each team tape the labels to the model where they think each part of the water cycle is being represented in the model. Then have each

student draw the model in their science journals and label the parts in their journal. Check for accuracy.

6. Have each individual student write a prediction in their journal about what will happen in their team's model. Ask them: What is their hypothesis about the grass seed? The water? What are they observing in this model that they can relate back to the water cycle on a global level? What purpose does the soil have in the water cycle? Water is stored as it passes through the water cycle. What bodies of water does the collector in bottle "B" represent?
7. Instruct students to observe their model on a daily basis for two weeks and record their observations in their journal. Divide two journal pages into six sections with the headings, *evaporation, condensation, precipitation, collection, percolation,* and *transpiration*. Encourage the students to record their observations specific to the components of the water cycle. Ask them to articulate what is happening at each stage in their model. To accommodate all students, observations can be written, expressed verbally to the teacher or drawn in their journal.
8. Ask students if they understand why we are drinking dino drool!

Assessment Suggestions

- Photograph interview. Take photos of the students building their models and the models "in progress." After the activity is completed (a week later) show the students the pictures and ask questions. You can do this as a group or individual interviews. As students observe the pictures, some questions that can be asked are:
  - What were you doing when this picture was taken?
  - What did you learn?
  - What more have you learned about the topic since the day of this picture?
  - How did you use what you learned?
  - What is happening in this picture as it relates to the water cycle?

Depending on the students and the experience being assessed some questions may be more pertinent than others. The teacher can create the questions that are the most important to measure student understanding. This type of assessment benefits students who may

struggle with writing or expressing themselves with the written word. An oral assessment allows them to demonstrate science vocabulary and concepts without getting mired in the process of writing. This type of assessment can make science learning visible by having students recall facts, concepts, applications and actions. A rubric can be created to measure the completeness of the students' answers.

- Team Evaluation – Ask each team member to evaluate their participation in the model building process and what they learned. (See *Team Evaluation* sheet.)
- Use the *Water Cycle Assessment Test* sheet to measure student understanding at different levels. The teacher can determine how many points constitute a letter grade. (See *Water Cycle Assessment* sheet)

Curriculum Extensions/Adaptations/ Integration

- To illustrate the effects of pollution on ground water add 10-15 drops of blue food coloring onto the growing grass seed. Wet each "lawn" thoroughly using the water bottle. This is to simulate rainfall. Within a minute or so, the food coloring should begin to circulate downward into the groundwater (Bottle A). Discuss with the students what dangers chemicals may pose to our water supply.
- Ask students to remove one of the components of the water cycle, i.e. light (energy source) or the water in bottle "A". Ask them to write a hypothesis about what they think will happen inside their model. Observe the model over the next week, recording observations. At the conclusion of the week have students compare their hypothesis to what they observed.
- Visual Arts – Utah State University International Office for Water Science Education sponsors a contest for elementary school students. Students from all over the state are invited to send in pictures depicting their interpretation of how they can conserve and protect our water supply. The winning entries are developed into a calendar. Each year has a different theme. The 2007-08 calendar's theme was Water and Me. This is a beneficial opportunity for students to share their water knowledge in a non-linguistic representation. For more information contact the USU Water and Science Education office. (See site address under *Web Sites*)

- Math – Have the student teams create a graph for a two-week period and measure the water that collects in bottle "B". The measurement can be in millimeters, centimeters or inches. They can empty the collector every other day so there is a baseline for each measurement. Have students take away the energy source (light) and see if the amount of precipitation is affected.
- Dramatic Arts – Students can design puppets, create characters, or use other props to act out the water cycle process.

Family Connections

- Let students take their model home and give a lesson to their parents and family. Have students include how important it is to conserve and save water. Have the students report back to class on their experience.
- "Deputize" your students and have them be "Water Waster Watcher" police officers at home. Provide "tickets" to hand out to family members who are "caught" using water unwisely.

Materials

- ❑ You Have Been Deputized letter
- ❑ Water conservation packet
- ❑ *Tickets*

Additional Resources

Books

The Water Cycle, by Trudi Strain Trueit; ISBN 0-531-16220-6

The Snowflake-A Water Cycle Story, by Neil Waldman; ISBN 0-7613-2347-3

A Drop of Water – A Book of Science and Wonder, by Walter Wick; ISBN 0-590-02319-5

A Drop Around the World, Barbara Shaw McKinney; ISBN 1-883220-72-6

A Teacher's Guide to A Drop Around the World, by Bruce and Carol Malnor; ISBN 1-883220-77-7

The Life and Times of a Drop of Water, by Raintree Press; ISBN 1-4109-1956-0

The Magic School Bus – Wet All Over, by Joanna Cole, Scholastic Inc; ISBN 0-590-50833-4

Web sites

http://www.uen.org/k12educator/

UEN has a link titled ***emedia***. The videos and clips on this sight can be downloaded, burned and used in your classroom. There are hundreds of 4th grade friendly science videos. Below are some that relate to the water cycle. Instructions to access the site: Click on ***emedia,*** click on ***Access emedia***, type in ***water cycle*** in the quick search

- *The Importance of Water* – Students learn that water is essential to life and discover many places that water can be found on Earth.
- *The Water Cycle* – Explains the water cycle as a whole as well as each part in detail.

- *NASA. SCI Files* – The Case of the Wacky Water Cycle.
- *The Magic School Bus, Wet All Over* – In the TV show "WET ALL OVER," Arnold and Wanda are due to give a report on the town waterworks. But Ms. Frizzle thinks it's field DRIP time! She turns the bus and class into water drops and the kids evaporate, condense, become rain and rush by river into the ocean. After several trips through the water cycle, they're ready to turn back into regular kids. But the magic key that will get them out of the cycle is locked in the school bathroom! Trying to work their watery way into the bathroom, the kids go through the town waterworks and see how water is purified. Can they get to school through bathroom pipes? Or are they stuck in the water cycle forever?

http://www.epa.gov/ogwdw/kids/flash/flash_watercycle.html

This website is an animated version of the water cycle.

http://pbskids.org/zoom/activities/sci/

A gold mine of fun science experiments that lets you explore the different properties of water. Click on the water link.

http://iowse.usu.edu

This links you to the Utah State University International Office for Water and Science Education, education page. You can also access information about the coloring contest mentioned in the extensions section.

Organizations

National Science Teacher Association, http://www.nsta.org/

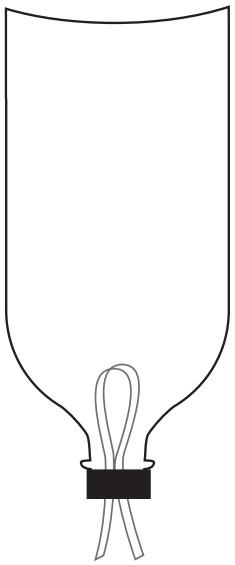
The National Science Teachers Association (NSTA), founded in 1944 and headquartered in Arlington, Virginia, is the largest organization in the world committed to promoting excellence and innovation in science teaching and learning for all. This organization is an excellent resource for seasoned and new teachers.

Building a Water Cycle Model

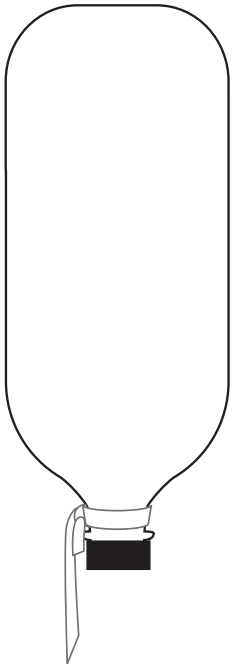
Team_____

1. Place the predrilled cap on Bottle "B". Insert a 30 cm (12") looped strip of a cotton shirt or rag through the hole so it hangs about 10 cm (4") down from the cap.
2. Tie the other 30 cm (12") cotton strip around the neck of bottle "C." Trim the piece of cloth so it hangs 5 cm (2") from the bottle opening. The piece of cloth hanging down should be trimmed like a necktie, its end cut to a point. Put a cap on bottle "C." The other cap will be used as a water collector in the model.
3. Assemble the model. Bottle "A" is the base of the model, with bottle "B" fitting "spout" first into bottle "A." Bottle "C" fits "spout first" into bottle "B." Once you know everything fits, it is time to fill the model, so you will be taking it apart.

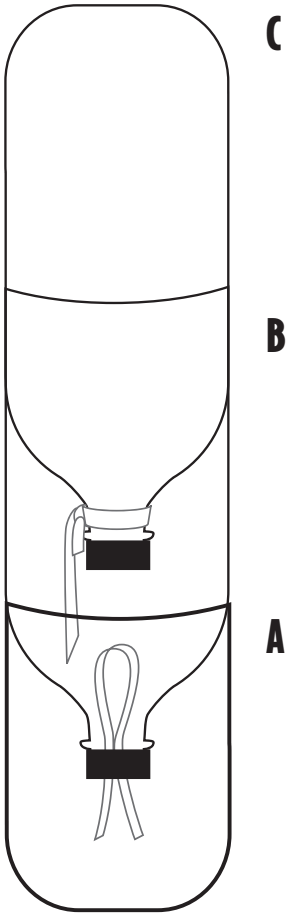
Bottle B



Bottle C

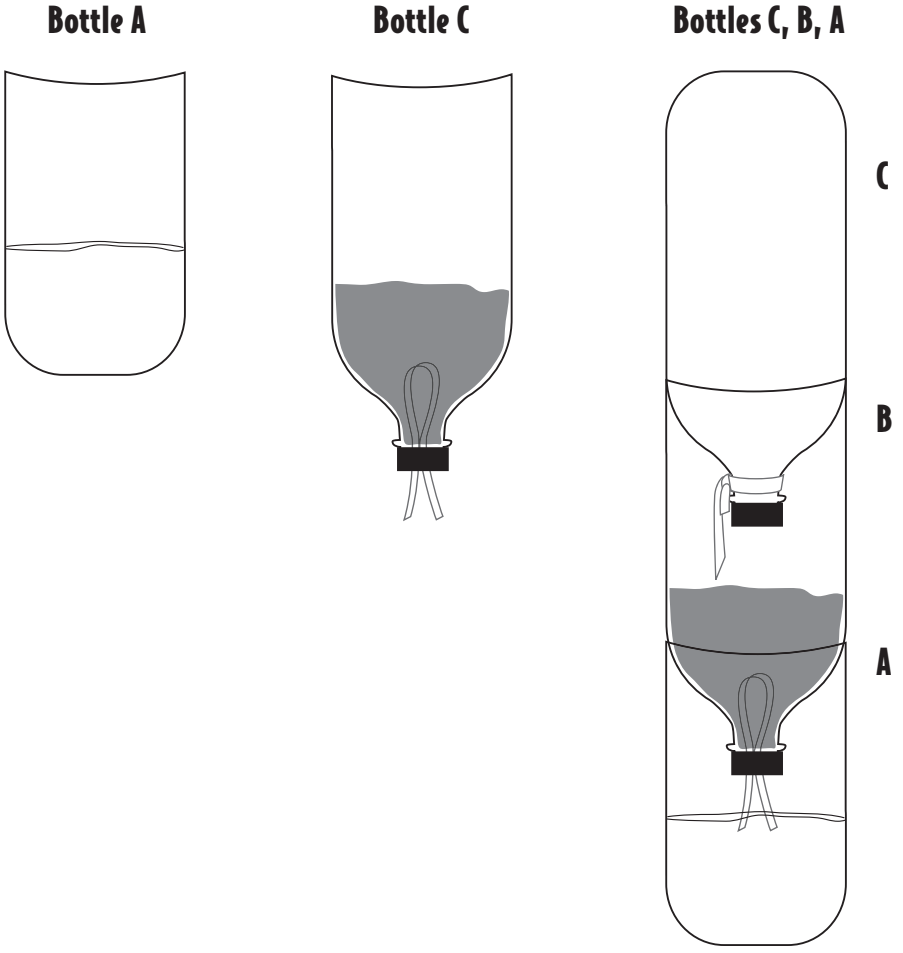


Bottles C, B, A

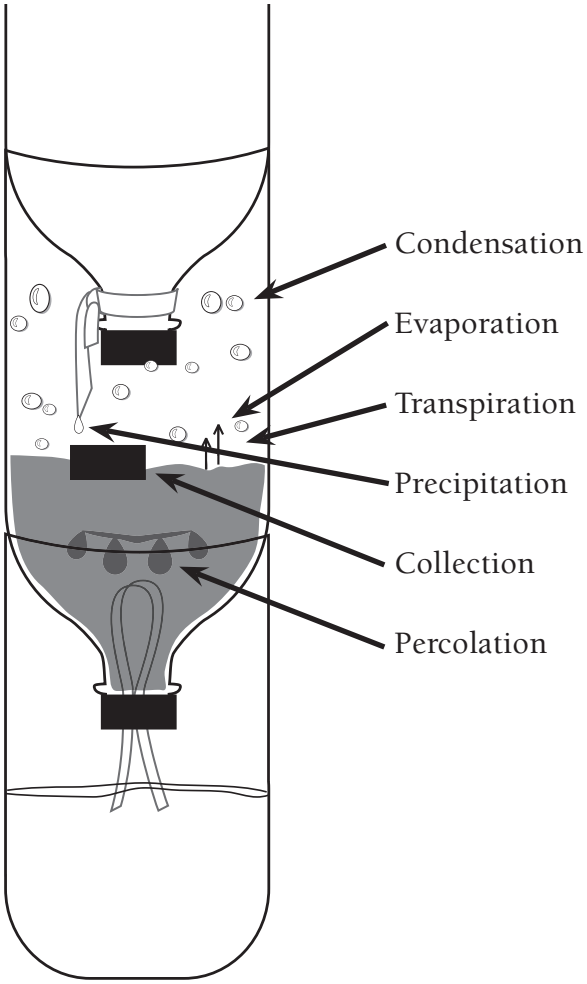


Fill the Water Cycle Model

1. Generously wet both strips of cloth. The moistness allows the water to travel along the cloth. This is called capillary action, which is the natural upward movement of water in confined areas, like the spaces between soil particles.
2. Add 250 ml (1 C) of water to bottle "A". This water will be the source of water for the cycle in the model.
3. Fill bottle "B" with a generous cup of pre-moistened potting soil. The soil should cover the loop of cloth.
4. Sprinkle a bottle cap of grass seed into the soil in bottle "B."
5. Take the remaining bottle cap and press it into the soil in bottle "B." This acts as a collection receptacle for water.
6. The cloth strip on bottle "C" should be adjusted so it hangs over the "pond" in bottle "B." this allows the water to collect in the cap.
7. Fill bottle "C" with 200 ml (2/3 C) of water and tightly close the lid. Do not put more water in Bottle "C" than directed. The weight of too much water can make the model top heavy and at risk of toppling over. Assemble the model and put it near a light source.



The Water Cycle Process



Write the six water cycle processes on the small labels below and attach them in their appropriate locations on the model. Use the above drawing as a guide.

Evaporation: Water traveling upward as vapor (gas).
Condensation: Water vapor turning back into a liquid.
Precipitation: Water falling from the sky as snow, rain, sleet, or hail.
Collection: Water collecting in puddles, ponds, rivers, oceans, glaciers, etc.
Percolation: Water mixing with soil.
Transpiration: Water evaporating from the leaves of plants.

Name _____ Date _____

Team Evaluation

1. Explain at least two specific ways that your team worked well during this activity.

2. Explain one specific way you would like to see your team improve for future activities.

3. State one specific way you contributed to your team in a positive way during this activity.

4. Describe in detail, what you learned about the water cycle and how the earth has a finite amount of water to fill the needs of everyone and everything on our planet.

The Water Cycle Assessment Test

Complete ____ points in answers on a separate sheet of paper. Place a checkmark by the choices that you complete. Due_____

Knowledge (5 points each)

_____ Define the terms percolation, transpiration, and energy. Tell where the water cycle gets its energy.

_____ Define the term water cycle. Explain the meanings for each of the six major processes that take place in the water cycle.

Comprehension (10 points)

_____ Write a paragraph that explains how the water cycle works on earth. Use all six water cycle terms in your response.

Application (15 points)

_____ Write a paragraph that explains how the water cycle works in your front yard.

Analysis (20 points)

_____ Brainstorm a list of 10 ways your family uses water and 10 ways your family can reduce water use to encourage water conservation. Write a contract for your family that will put three of these ideas into practice. Report back to the class after 3 weeks to let them know how your contract worked.

Synthesis (25 points)

_____ Create a song, poem, or rap that illustrates the water cycle. A 25 point response will use the following words in a meaningful way; evaporation, condensation, precipitation, collection, percolation, and transpiration. Be prepared to share your artistic rendition with the class.

Evaluation (30 points)

_____ Respond to this statement; "If we are not careful, one day Earth will run out of water." Write a 100+ word response that uses research to support your informed opinion. Include your rough draft with your final copy and a bibliography of your research.

Family Water Conservation Checklist

YOU HAVE BEEN DEPUTIZED! IT IS YOUR DUTY TO ORDER ALL WATER WASTERS TO CEASE AND DESIST THEIR WASTEFUL WAYS!! You have the power to ticket any and all family members who you find wasting water. Discuss with your family ways you can save and conserve water.

Bathrooms	Suggestions
1. Have toilet tanks been checked for leaks? ❑ Yes ❑ No	Place a few drops of blue food coloring in the toilet tank. If you can see the color in the toilet bowl without flushing, a wasteful leak needs to be repaired.
2. Is the toilet being used as a wastebasket? ❑ Yes ❑ No	Extra toilet flushes can waste up to 7 gallons of water with each flush.
3. Do you turn the water off while brushing your teeth? ❑ Yes ❑ No	Before you begin brushing, wet your brush and fill a glass for rinsing.
Kitchen/Laundry	**Suggestions**
1. Are dishwashers and washing machines used only for full loads? ❑ Yes ❑ No	When you run full loads in your appliances you save water and energy, and your machines will last longer.
2. Is water left running for rinsing produce or dishes? ❑ Yes ❑ No	Keep the water in the sink with a stopper, a great conservation idea!
3. Have your faucets been checked for leaks? ❑ Yes ❑ No	Repair leaks as soon as possible. One drip per second wastes more than 2,400 gallons of water per year.

Outdoor Use	Suggestions
1. Are lawns and shrubs watered only when it's really needed? ❑ Yes ❑ No	Check your lawn before watering. A lawn that springs back after being stepped on doesn't need water. Most shrubs need only one monthly deep watering during the summer.
2. Is your lawn watered before 10 a.m. or after 5 p.m.? ❑ Yes ❑ No	Water only during the cooler parts of the day. The sun can cause most of the water to evaporate before it is absorbed into the soil.
3. Are your walkways or driveways swept for cleaning? ❑ Yes ❑ No	Sweep your driveway and walkways instead of using a hose to clean them off.
4. Is water left running while washing your car or RV? ❑ Yes ❑ No	Fill a bucket with soapy water and wet down your vehicle. Turn off the hose and wash your car with the soapy water from the bucket. Rinse with the hose. A hose left running can waste up to 10 gallons of water per minute.

Water Waster Violation

Uh Oh! You are being cited for wasting water!

Date: _____

Name: _____

Infraction:	Ways to fix the problem:

Water Waster Watcher Deputy: _____

Round and Round

Science Standard I

Objective 2

Connections

Standard I:

Students will understand that water changes state as it moves through the water cycle.

Objective 2:

Describe the water cycle.

Intended Learning Outcomes:

1. Use science process and thinking skills
3. Understand important science concepts and principles.
4. Communicate effectively using science language and reasoning.

Content Connections:

Language Arts VIII-6; Write in different forms and genres

Background Information

Water is such a basic life sustenance that it is easy to take for granted. Water is a substance that can naturally occur in three different forms, solid, liquid, and gas. The solid form of water can be found in the glaciers and ice caps on the opposite poles of Earth. We are most familiar with water in its liquid form. We see it in our lakes, rivers, streams, and oceans. Water vapor rises into the atmosphere and condenses back into a liquid through clouds, fog, and mist. The water then falls to Earth in the form of rain, hail, sleet, and snow to nourish our planet and sustain life.

Much of Earth's water is in constant motion, and the water cycle describes the continuous movement of water on, above, and below the surface of Earth. The water cycle is truly a "cycle," with no beginning or end. The vocabulary words, *evaporation, condensation,* and *precipitation* describe the continuous movement of water into the air and ground, onto and over land and back.

This activity will take 2-4 class periods, depending on how involved the students are in creating the final product.

Research Basis

Harlen, W. (2001). *Primary Science…taking the plunge; How to teach primary science more effectively for ages 5 to 12.* Portsmouth, NH: Heinemann.

An increase in student learning occurs when students have opportunities to discuss what they have observed and inferred in small groups and as a class. Elementary students' science learning needs to be scaffolded around a metacognative approach, where students are

asked to think about what they know (what they can directly observe) and what they do not directly know (what they need to infer).

Kluger, B. B., (1999). *Inquiry thoughts, views, and strategies for the K-5 classroom.* National Science Foundation, Arlington, VA.

In inquiry-based classrooms, teachers support students as active learners as they explore, carefully observe, plan and carry out investigations, communicate through varied methods, propose explanations and solutions, propose thoughtful questions, and critique their science practices. Good science inquiry provides many entry points—ways in which students can approach a new topic—and a wide variety of activities during student work.

Invitation to Learn

With a permanent marker write Evaporation, Condensation, and Precipitation around the perimeter of a Frisbee®. Write WATER CYCLE in the center of the disc. Have students stand in a circle. Toss the Frisbee® to a student. Have the student recite the steps of the water cycle from where their hand caught the disc. For example, if the disc is caught on the word "Evaporation," the student will tell what happens when water evaporates and relate the next steps in the cycle after evaporation, which are condensation and precipitation. This can be repeated as often as desired. For the second round, play the song "Water Cycle Boogie" and toss the disc around the circle. When a student catches the disc on a water cycle "step" they will act out the word. For example, if the disc is caught on "precipitation," the student will indicate a downward motion. If it is caught on "evaporation," the student will indicate an "up" motion. To add to their movement have the students go "round and round" in the circle as they toss the Frisbee® back and forth to each other.

Materials

- ❑ Frisbee®
- ❑ Black marker
- ❑ *Singing in Our Garden*
- ❑ Chart paper
- ❑ Watercolors
- ❑ Crayons
- ❑ Paper

Instructional Procedures

1. Divide the class into 4-5 groups. Provide each group with review resources about the water cycle. (See the booklist from the Dino Drool activity) There is a student reference guide at http://www.schools.utah.gov/curr/science/core/4th/TRB4/default.htm that can be downloaded and distributed to students.
2. On an easel sized Post-it®, have students write down the information they think is important to know for someone who is just learning about the water cycle. Tell them they are becoming authors of their own water cycle book. Play the

"Water Cycle Boogie" as they work. Instruct the groups to use the song's organization to help them create their story.

3. Once the students have determined how they want their facts to be represented, give each group another easel sheet and have them create a rough draft "storyboard", complete with text and illustrations.
4. The final draft can be on any type of paper. Markers, colored pencils, crayons, and watercolors can be used to create color and interest in the illustrations. The students can choose to make a book, a final storyboard, a DVD, or a mural.
5. Have students share their final product and teach the water cycle to a younger audience. If there is an opportunity for a school wide science fair or other school wide audience, have students share their product.

Assessment Suggestions

- Photograph interview – see Dino Drool activity.
- Card sorts – This type of assessment measures student attitude and knowledge toward science and what type of science student they are.

Print individual cards with the water cycle vocabulary and attitude descriptions. Allow students to group the cards according to the water cycle and have them match science attitude cards to their science knowledge. Attitude cards such as, "Thinks up good questions" or "Thinks up own ideas to study" are paired with knowledge cards such as " Precipitation is_____". (Student fills in the blank.) You can use this assessment at the beginning, middle and end of an activity to measure understanding.

Curriculum Extensions/Adaptations/ Integration

- Science - Cover a medium sized box with question marks. Put a container of water inside the box. Invite students to ask questions so they can determine what is inside. Instruct students to ask three types of questions:
  - Does it _____? / Can it _____? (verbs)
  - Is it_____/ (adjectives)
  - Does it have_____? (nouns)

They may want to ask specific questions like, "Is it a leaf?" or "Is it a spider?" right off the bat. The purpose of asking the above questions is to help the students gather information so they can make an educated inference about what is in the mystery box, not a lucky guess.

A student/teacher exchange might go like this:

Student: "Can it move?"

Teacher: "Yes, it can move?"

Student: "Does it have six or more legs?"

Teacher: "No, it does not have six or more legs?"

Student: "Does it have four legs?"

Teacher: "No, it doesn't have four legs."

Student: "Does it have legs?"

Teacher: "No, it does not have legs."

Student; "Is it a snake?"

Teacher: "No, it is not a snake."

This exchange may give you an idea of how to answer and guide the inquiry. You can introduce the properties of water through this type of question/answer activity. Just because it moves, does not mean it is an animal! Water also conducts electricity, but it is not metal!

As the teacher and student exchange information, write down the responses on three pieces of chart paper with the headings, verbs, adjectives, and nouns. Stop the questioning when you feel he students can make an educated inference about the mystery box's content. Ask them to write or draw what they think the mystery object is using this lead, "I think/infer that the mystery object is _____. You can also ask, "Are you 100% certain?" Point out that the questioning process is vital to science understanding and discovery.

At the end of the questioning, the container of water is revealed. Make the list of nouns, verbs, and adjectives available to help the class continue their inquiry into water and to journal their science experience.

- Divide students into four groups to participate in four stations. Students will record their observations, draw pictures, and make inferences about each step in the water cycle in their journals.

  Evaporation Station

  Condensation Station

  Precipitation Station

  Water Cycle Station

- Read the book *Water Dance* by Thomas Locker. identify the nouns, verbs, and adjectives that describe each part of the water cycle from the book, under the word strips, evaporation, condensation, precipitation, and water cycle.
- Invite students to highlight and identify the words on the posters that best describe the water cycle according to what they have come to understand through their experiments and experience and highlight them on the posters.
- Ask students, "What have you learned?" Direct them to write a reflection about their learning over the past few days. Have them look at their predictions, their observations and their inferences about the water cycle in their journals. Instruct them that they will need to use the water cycle vocabulary in a meaningful way, using the parts of speech displayed and discussed in class to help the reader understand the water cycle and its importance to our planet.
- Language Arts/Visual Arts – Have students create their own "Water Dance " book using their reflection vocabulary and watercolors.
- Science /Social Studies – Have students do Internet research on different world biomes, rain forest. desert, wetland, etc and graph the different amounts of annual rainfall in these areas. Do the same for Utah counties and compare and contrast Utah's rainfall with other world biomes.

Family Connections

- Have students share their water cycle reflection with their family. Discuss other parts of speech that describe the water cycle to help create understanding of the water cycle process.
- Students can perform a "Water Cycle Boogie" for their family.
- Students can use their final product to teach their family about the water cycle.

Additional Resources

Books

Water Dance, by Thomas Locker; ISBN 0-15-216396-4

Where the River Begins, by Thomas Locker; ISBN 0-14-054595-6

The Earth Science Book – Activities for Kids, by Dinah Zike; ISBN 0-471-57166-0

Daily Warm-ups – Earth Science, by Walch Publishing; ISBN 0-8251-4454-X

Picture-Perfect Science Lessons, by Karen Rohrich Ansberry and Emily Morgan; ISBN 0-87355-243-1

More Picture-Perfect Science Lessons, by Karen Ansberry and Emily Morgan; ISBN 978-1-93353-112-0

Media

Singing in our Garden, CD, Banana Slug Band; ISBN 680598 00272 5

What's the Weather, Puppets - 6 hand puppets that facilitate this activity. Oriental Trading, Hands on Fun Catalog, Summer 2008 MV-58/1017, pg. 86.

Web sites

http://www.surfnetkids.com/watercycle.htm

This site links you to a number of "kid friendly" sites related to the water cycle.

http://www.schools.utah.gov/curr/science/core/4th/TRB4/default.htm

This is the USOE website for 4th grade science core curriculum.

Card Sorts

Define the water cycle.	**Describe the process of condensation.**
Name 4 types of precipitation.	**What is evaporation?**
What is the energy source of the water cycle?	**Use 3 adjectives to describe the water cycle.**

What would happen to the water cycle if the sun didn't shine?	**Where will evaporation happen faster on a sunny day, in the morning or afternoon?**
Use 3 nouns to describe the water cycle.	**Use 3 verbs to describe the water cycle.**
Where are some places in your home that you can observe condensation?	**I can think up good questions.**

I can think up my own ideas for study.	I can ask for more time to finish my experiments.
I can complete my work on time.	I can work together with my peers to find answers to our questions.
I can use different resources to answer my questions.	I can write and draw with care in my journal.

My reflections in my journal are important and meaningful.	

Evaporation Station

– Ask the question, "How does water get into the air?"

Materials:

Three small plastic plates
Three different colored markers
Water

Directions:
Make a shallow puddle of water on each plate. Trace each puddle with the same color marker to indicate the size of the puddles.

Number the plates and place them in three different areas: direct sun, complete dark, and in the middle of the classroom.

Write a prediction in your journal about what will happen on each plate.

Sun _____

Dark _____

Partly sunny (classroom) _____

Check the puddles after one hour and trace each puddle with the second color marker.

Describe, in your journal, how they puddles have changed.
Check the puddles the next day. Trace each puddle the third color marker.
Draw pictures of the plates in your journal using the 3 different colors to show what happened.

Answer these questions:

Which puddles shrank?
Why do you think the puddles shrank at different rates?
What do you think happened to the water?
What other questions do you think are important to ask about evaporation?

Condensation Station

- Ask the question, "How does condensation form?"

Materials:

Pint glass jar
Water
Ice cubes

Observe the jar as it rests at room temperature, without any water. Write your observations in your journal. How does the jar feel? What does it look like?

Fill the jar with ice and water. How does the jar feel on the outside? After a few minutes what does the jar look like?

Leave the jar full of ice water for about a half hour. Write your observations about what the jar looks like and feels like.

Explain how you think water appeared on the outside of the jar.

Precipitation Station

– Ask the question, "How is rain made?" (teacher directed)

Materials:

Quart glass jar with a lid
Ice cubes
Boiling water

Predict: What do you think will happen when ice cubes are put on top of the jar of hot water?

The teacher will add about one inch of boiling water to the jar. Place the lid upside down on the mouth of the jar to create a lip. Place three to four ice cubes in the lid.

Draw two pictures in your journal – One picture of the jar of hot water as soon as the ice is placed on the lid. And the other picture after 5 minutes have passed.

Write your observations at:

- 1 minute
- 2 minutes
- 3 minutes
- 4 minutes
- 5 minutes

Why do you think water formed at the top of the lid?
How do your observations compare with your prediction?

Water Cycle Station

- Ask the question, "How does the water cycle work? Does the water cycle need an energy source?"

Materials:

Song: *Water Cycle Boogie*

Watch and/or listen to the Water Cycle Boogie. Draw in your journal a visual representation of the water cycle.

Where would you have the cycle begin?

Could we have the water we need if one of the steps were eliminated?

Why is the sun important to the water cycle?

What do you think it means for the water cycle to go "round and round" and "up and down?"

Why is the water cycle important to life on Earth?